

# The Aviation Historian®

The modern journal of classic aeroplanes and the history of flying

## ON A WING AND A PRAYER THE 1971 ROLLS-ROYCE BANKRUPTCY

ISSUE  
34



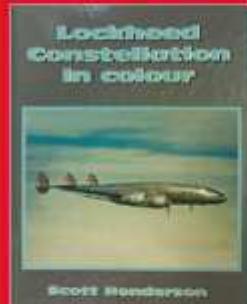


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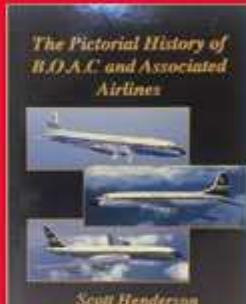
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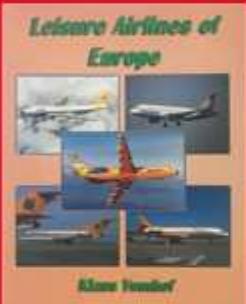
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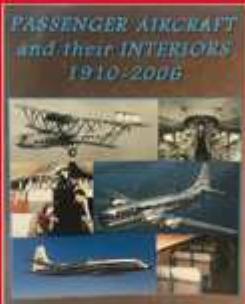
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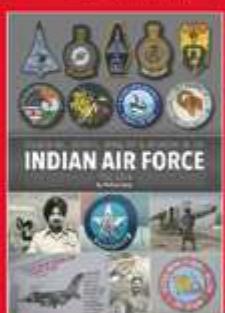


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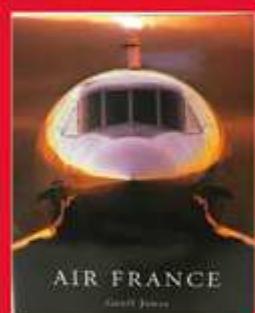


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# The Aviation Historian®

The modern journal of classic aeroplanes and the history of flying

## Editor's Letter

FIRST, A VERY happy new year to all our readers. With 2020 having been one of the oddest and most trying in living memory, and with Covid-19 vaccines now being rolled out, let's have faith that 2021 will see at least the beginning of a return to a more normal life, whatever that will look like in a (hopefully) post-Covid world.

Our previous issue, TAH33, incorporated our first ever colourised cover image, and it generated a fair bit of interesting feedback in correspondence and on social media. Reader Stephen Luscombe remarked: "I don't mind colourisation as long as [the artist] has tried hard to get the colours right — it is really about evoking a mood". On the other hand, colourisation is clearly a bugbear of prolific aviation author Graham Simons, who said: "I strongly disagree with it; it's 'faking' history, simple as that — something no historian should ever do. You have freely admitted what has been done, but ten years down the road I bet there will be someone on the internet vehemently claiming it's a colour original". Our Managing Editor, Mick Oakey, adds another view: "When we reproduce archive black-and-white images, we regularly adjust brightness and contrast if the original print is faded. So even monochrome images are often manipulated to some extent, and people do not object to that".

All are valid perspectives and raise very good points. My own feeling is that colourisation adds a different flavour and can sometimes enhance and clarify a photograph; however, we will only ever use it sparingly in TAH. We will always aim for the best possible accuracy, and will make it clear that the image has been modified. It's a fascinating debate, and I would certainly like to know what you think.

Finally, this new issue of TAH contains the usual rich and varied mixture of articles, with a global reach, spanning 12 decades. We even explore a 1950s RAE concept for a fur-covered Mach 5 personal transport . . .

**FRONT COVER** *The power and — eventually — the glory. A Qantas Boeing 747's starboard pair of Rolls-Royce RB.211-524s, still working hard in July 2007. See pages 10–18.* DARREN KOCH

**BACK COVER** *A colourised image of an RAF Douglas Boston crew in North Africa. Vic Flintham's two-part series on the Rover David close air support system starts on page 20.* VIA VIC FLINTHAM

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# AIR CORRESPONDENCE



## Letters to the Editor

### Nuclear propulsion pipedream?

**SIR** — Can any of your contributors or readers help me? I read with interest the section on nuclear propulsion in *Hawker's Star Destroyer* in TAH32 but I cannot work out how feeding heat into the compressor section of a turbine engine will produce a useful amount of thrust. It will certainly cause expansion of the cold incoming air, but by how much?

Were static tests ever carried out using nuclear heat to feed a gas turbine? And, if so, what was the outcome?

It appears to be another optimistic dream about the nuclear future that was common at the time, rather like R.C. Abel's drawing note of "pinched plasma".

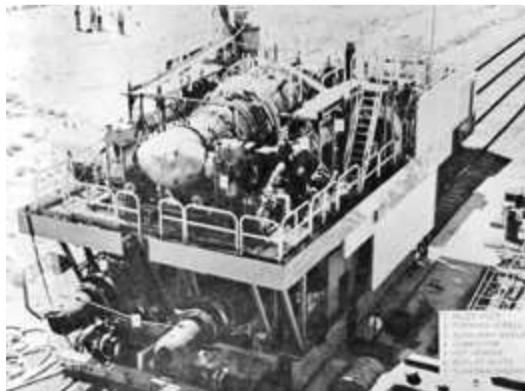
**Roger Beardsworth** Blenheim, New Zealand

*[How a nuclear reactor was linked to a gas turbine (jet) engine is explained in Jakob Whitfield's article Radiant Skies in TAH4, about the plan to fly a nuclear-powered Convair B-36. Essentially the reactor replaces the engine's combustion chamber, and heats and expands the incoming air in the same way as the burning of a fuel/air mixture,*

thus creating thrust. Static tests were indeed performed, beginning in January 1956. General Electric's detailed report on its final nuclear powerplant experiments for the B-36 project — Heat Transfer Reactor Experiment Number 3: Comprehensive Technical Report, General Electric Direct-Air-Cycle Aircraft Nuclear Propulsion Program — in which a reactor-powered pair of X39-5 engines (modified J47s) successfully completed 100hr+ of running despite a meltdown incident, is available online at <https://digital.library.unt.edu/ark:/67531/metadc101099/m1/1> — Ed.]

### Flying-boat or landplane?

**SIR** — The feature *Hawker's Star Destroyer* by Chris Gibson in TAH32 was quite fascinating but I am not sure the "Star Destroyer" was ever intended as a flying-boat, although the term "waterline" does imply that. Reaching for my copy of *FAA Advisory Circular AC65-15A, The Airframe & Powerplant Mechanics Airframe Handbook*, page six reveals the definition of "Water Line" as "The measurement of height in inches perpendicular from a horizontal



**ABOVE** Two views of HTRE-3 (see Editor's reply to the first letter on this page) — the third and final Heat Transfer Reactor Experiment test assembly — at the Idaho National Laboratory (INL). These images, from General Electric's report cited above, show the nuclear reactor on the upper level (with external shield in place **ABOVE LEFT**), and the nozzles of the two X39-5 axial-flow turbojet engines protruding from the lower level. This test rig survives, and is on public display adjacent to the car park of the main INL Experimental Breeder Reactor site west of Idaho Falls, having been moved about 30 miles (48km) south from Test Area North, where the trials took place during 1958–60.

plane located a fixed number of inches below the bottom of the aircraft fuselage". The side view illustration depicts a landplane, with its waterline shown.

**Dave Welch** via e-mail

**Chris Gibson** replies:

*That is a very interesting point, and it might explain something (one of many things) I could not reconcile from the drawing (the only extant evidence for this study). I couldn't understand why you would design a craft with its VTOL propulsion nozzles under the waterline when at rest. At some point the propulsive gases would aerate the water and the machine would lose buoyancy. It's a problem we have on oil rigs. And they sink — a 60,000-ton vessel just goes "plop!" into the drink. Would the thrust counter this loss of buoyancy? Who knows?*

*As a landplane the "Star Destroyer", at least on the drawing, shows no alighting gear. VTOL aircraft studies of similar vintage, e.g. the Avro 730 née 727 from 1955, had small alighting gear capable of holding it up on the ground but not suitable for the rigours of rolling take-off and landing. I would have expected such gear on the "Star Destroyer" to be hefty enough to merit showing on the drawing. Mind you, I don't recall drawings of Alan Griffith's VTOL airliners, packed with lift jets, showing undercarriage.*

*The other explanation is that the "waterline" refers to the aircraft's attitude when ditched. However, I've only ever seen that on specific reports for designs that were well under development. I'll need to check, but I can't think of a company drawing, apart from a seaplane, with a waterline on it. I'm happy to be corrected.*



OTAGO WITNESS

**Major players involved with Ryan Broughams in Australia — see Errol Martyn's letter on this page.** ABOVE LEFT Moncrieff (left) and Hood pose for the camera in front of the Aotearoa at Sydney's Richmond aerodrome. ABOVE The flyers and their supporters, pictured here in high spirits just before the Aotearoa's departure for New Zealand, perform the farewell song *Auld Lang Syne*. Moncrieff is fourth from the right in the front row, Hood sixth and Kight seventh. RIGHT Ivan Kight.

*I'd love to find more on this beast, and I suspect TAH's readership will have much to add.*

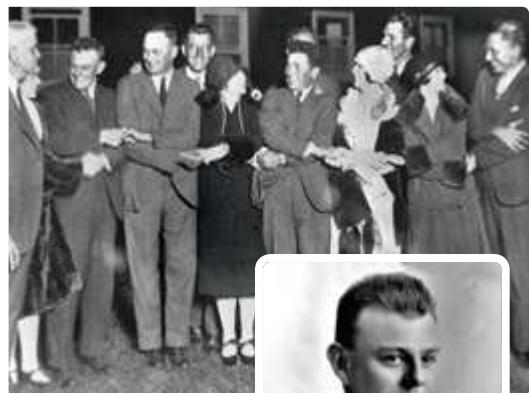
*The other aspect that really bugged me is the guns. Three large guns, that look like naval rifles off the Japanese battleship Yamato, arranged radially. What's going on there? Schräge Musik designed by Father Dougal McGuire?"*

## Ryan Broughams Down Under

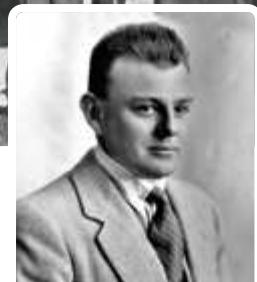
**SIR** — In his interesting summary (in TAH30) of the Ryan Brougham in Australia, Neil Follett writes that John Moncrieff and George Hood had ordered G-AUNZ from the Ryan company. Although Hood was one of the two crew on board for the failed trans-Tasman flight attempt, he was a latecomer on the scene.

The original plan was for Moncrieff and Captain Ivan Louis Kight to pilot the Brougham, one relieving the other at the controls during the flight. The pair between them, in 1927, following Lindbergh's famous solo non-stop flight across the Atlantic that May, decided that a Brougham would also be a most suitable machine for a Tasman attempt. Moncrieff, whose uncle contributed a substantial sum towards the flight, was a mechanic by trade, and Kight a solicitor; so it fell to Kight to be the most heavily involved in the purchasing arrangements. Later, in Australia, he also played a critical role in overcoming last-minute Australian objections to the flight attempt taking place.

In November 1927 Kight, an ex-RFC pilot, failed his medical and was no longer permitted to fly as a pilot. In his place was selected Captain Maurice William Buckley, who was a flying instructor with the New Zealand Permanent



AIR FORCE MUSEUM OF NEW ZEALAND



KIGHT FAMILY



ABOVE This "Reversing Stop Watch for Equal Distance Bomb Sight", crudely inscribed on its reverse, is in the possession of subscriber John Barker (see his letter on this page). John is keen to know more about how it was used — and so are we! Who amongst TAH's readership has the manual and/or can enlighten us?

Air Force at Wigram. It seems that the Defence authorities, not keen on risking their valued asset on this non-military venture, prevented Buckley from taking part. Now having in turn to replace Buckley, Moncrieff and Kight selected George Hood, a farmer — and, like Moncrieff and Kight, also a member of the territorial New Zealand Air Force — as second pilot.

When the monoplane was received in Australia, however, the New Zealanders discovered that, because of the installation of a long-range fuel tank in the cabin, and contrary to pre-delivery reassurance from Ryan, it could be piloted by only one of the crew once airborne. The other member, being unable to change places with the pilot in the air, would instead attend to the wireless transmitter located behind the long-range tank.

There no longer being a need for a second pilot, Kight and Hood then decided between them on a coin toss for the honour of accompanying Moncrieff. Hood won, and, along with Moncrieff, was lost without trace during the flight attempt. Sadly, Kight did not long outlive his comrades, being killed in a flying accident in New Zealand three years later.

New Zealand's Hood Aerodrome is named after George Hood, but there is no memorial to Kight, without whom the flight attempt would in all likelihood never have come about in the first place.

**Errol W. Martyn** Christchurch, New Zealand

### Forwards and backwards in time

**SIR** — I am a new subscriber to your journal, on the recommendation of Scott Barrett at *The Automobile* magazine.

The accompanying photographs show a

Reversing Stop Watch for Equal Distance Bomb Sight, Mark II, manufactured by Birch & Gaydon Ltd. To the reverse is scratched/engraved "Flying Armament School 102 Manston". I am very interested to find out how one used the item, which works as a normal stopwatch but then, when the top button is pressed it reverses. Also the graduations are not in seconds. I wonder if any of your readers can help?

**John Barker** via e-mail

[Who can give us chapter and verse? — Ed.]

### An equally odd propeller

**SIR** — Since my last letter to you regarding the Cyrnos propellers [main article in TAH30, previous letter in TAH31 — Ed.], I have stumbled across the photographs herewith, depicting a propeller of remarkable similarity to one of the Cyrnos designs, but credited to another designer. One image is a front close-up of the Parent monoplane of 1910, which has a caption in French on the reverse which reads:

"A new propeller.

"The RIP propeller built by Raymond Petit was tested on the Parent monoplane. Although having blades of only 2m [79in] diameter, this propeller gave at the fixed point results equal to those of a propeller of 2m 50 [98in]. It is hoped to gain with this propeller an increase in speed [of] from 6 to 7km/h [3½–4½ m.p.h.]. The air attacks via the centre and not via the extremities."

The manufacturer's initials, "RIP", are clearly stamped on the propeller hub. The engine was a 70 h.p. Labor-Aviation.

The other photographs are of the Goldschmidt monoplane of circa 1911, clearly showing the RIP propeller mounted in front of the Gnome engine, again with the RIP stamp in evidence.

It seems that the Cyrnos and RIP propellers co-existed. It would be nice to know whether there was any connection between the two makers.

**Philip Jarrett** Dorking, Surrey

### No ALARM intended

**SIR** — I have been reading *Shorts: The Perennial Thorn* by Prof Keith Hayward (TAH32).

I have great respect for Prof Hayward's research, including numerous TNA references, but I have to comment on an error on page 41.

To the best of my knowledge, Shorts had nothing to do with the ALARM air-launched anti-radar missile, which was developed by BAC's Guided Weapons Division at Stevenage in association with MSDS at Stanmore under AST 1228 (feasibility studies), and later the Dynamics Group of British Aerospace plc under ASR 1228 (project definition and production for the RAF).

During 1977-79, I worked on the Harassment Drone project under AST 1232 at BAC GW division at Bristol but also attended official meetings for AST 1228, given the commonality of target radars and threat. Thus I had intimate knowledge of ALARM during that period.

There may have been diplomatic pressure for the UK to buy the American AGM-88A HARM

anti-radiation missile, which was a direct competitor, but this had nothing to do with Shorts. I guess too that there may have been diplomatic pressure to purchase the American FIM-92A Stinger shoulder-fired anti-aircraft missile instead of the Shorts Javelin, which was developed from the Blowpipe shoulder-fired anti-aircraft missile, but I have no direct knowledge on this subject. Prof Hayward's article mentions neither Blowpipe nor Javelin.

**Martin S. Best** Bristol

[Correct. For ALARM read HARM — Ed.]

### Mystery airfield identified

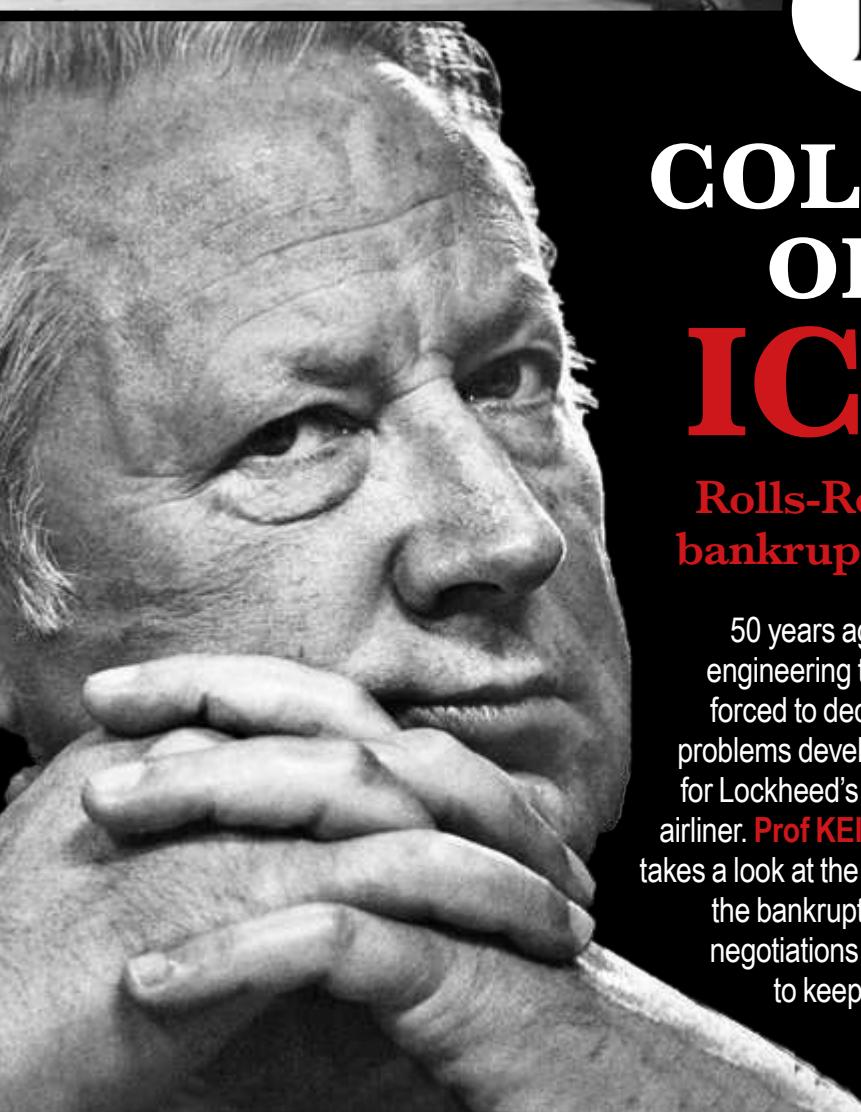
**SIR** — I much enjoyed Bill Cahill's article on *Graypea Mosquitoes* in TAH33. The photograph of a USAAF Mosquito over "an unknown airfield" caught my eye because for years I've been puzzling over the identity of the location. Looking again at the original print, there appeared to be Lancasters on the hardstandings. Then, using Ken Delve's book *Military Airfields of Britain: East Anglia* (Crowood, 2005), I tracked it down to Tuddenham, some 23 miles south-west of Watton, the Mosquito's base. So, thanks to Bill for nudging me to further research.

**Tony Fairbairn** Chippenham, Wiltshire



**Philip Jarrett** has sent us these images of the Cyrnos-lookalike RIP propeller. CLOCKWISE FROM TOP LEFT The prop installed on the 1910 Parent monoplane; the caption on the back of the print; two views of another RIP prop used on the Goldschmidt monoplane (very reminiscent of an Antoinette). See Philip's letter on these pages.





# COLLAPSE OF AN ICON

**Rolls-Royce 1971 —  
bankruptcy & bailout**

50 years ago illustrious British engineering titan Rolls-Royce was forced to declare bankruptcy after problems developing its RB.211 engine for Lockheed's equally troubled L-1011 airliner. **Prof KEITH HAYWARD FRAeS** takes a look at the causes and aftermath of the bankruptcy, and the fraught negotiations that followed in its wake to keep the RB.211 project alive

**E**DWARD HEATH WAS not expected to win the UK's June 1970 election. His Conservative Party's industrial policy was to be based on the slogan of "no lame ducks" and an end to state aid for ailing industries. In terms of aerospace policy, the Heath government had to accept the commercial death of Concorde and the end, or so it seemed, of any official British interest in large civil aircraft. But worst of all, within six months of winning the election, Heath faced the collapse of one of the most illustrious names in British manufacturing — Rolls-Royce. This was primarily caused by the latter's contract to supply RB.211 engines to Lockheed for its L-1011 TriStar airliner. This article focuses on the politics of the painful aftermath of the company's bankruptcy and the desperate attempt to save the RB.211.

### DEFEAT FROM THE JAWS OF VICTORY

The 1967 Lockheed contract was won by Rolls-Royce after a strenuous campaign to gain a foothold in the lucrative American market. The deal was the commercial breakthrough for the company's aero-engine headquarters at Derby, and rapidly outshone work on a collaborative engine for the nascent European "airbus" project. [See the author's *Airbus Industrie in TAH28 — Ed.*] The Lockheed contract had been embraced by the previous Labour government, earned two knighthoods for Rolls-Royce executives and seemed to set the British company on course for a secure and profitable future.

By 1970, however, things were turning sour. A combination of technical problems with the RB.211 and a miscalculation of the inflation clause in the Lockheed contract created a financial crisis for Rolls-Royce. Matters were compounded by a belief held by both Rolls-Royce and Lockheed that, *in extremis*, the British government would intervene to bail Derby out. The Labour government had advanced more than was usual in terms of "launch aid" (state subsidisation of development in return for a future share of profits), and had basked in the reflected glory of the deal; but there was no official guarantee of further support should it become necessary. However, in a last act before the election, the Labour government had agreed in principle to authorise a £10m loan from the IRC, a government quango set up to bankroll UK industry.<sup>1</sup>

The growing crisis at Rolls-Royce was discussed in Cabinet on October 15, 1970, members receiving a detailed report on the current state of affairs and the amount of money Rolls-Royce might need to

meet its obligations. It was clear that the company faced collapse within 48hr without further support or loan guarantees. This would "cause serious damage to our own defence production and would have worldwide repercussions on the aircraft and defence industries".

Further City support for the company depended on assurances that the government would underwrite future engine projects. The government was also conscious that in launching a "salvage operation" at Rolls-Royce, it could become responsible for the company's total liabilities. The Cabinet agreed that support would be limited as far as possible and that Rolls-Royce might have to face a more constrained future "under new management in the military and small civil aero-engine market".

Total collapse would have serious implications for future European collaboration, and the liquidator would have no means of blocking sale to an American buyer. Rejoining the Airbus project had its attractions for some members of the Cabinet, but this would be of little benefit to Rolls-Royce. Although the Conservatives were set to abolish the IRC, they were sufficiently concerned by Rolls-Royce's growing liquidity problem to consider in principle an extension of the original launch-aid agreement and to underwrite steps to obtain more money from the company's bankers.<sup>2</sup> There was grave concern that failure to support Rolls-Royce would lead to liquidation, which was "not really open, in view of the high cost of the indemnity to Lockheed, the effect on the defence programme and the risk of a US take-over".<sup>3</sup>

### DELAYING THE INEVITABLE

Announcing a £60m rescue package in November 1970, Minister of Aviation Supply Frederick Corfield stated that Rolls-Royce was not one of the "lame ducks" the government had decreed should be allowed to go to the wall. On the contrary, he argued, Rolls-Royce was a considerable national asset and the company would overcome its current problems. But further aid would be subject to an independent examination of Rolls-Royce's finances and its management of the RB.211 programme by Sir Henry Benson of accountancy firm Cooper Brothers & Co. This was an important caveat missed by Lockheed, which itself was in some difficulty delivering the TriStar. But, as subsequent events would soon show, the government's statement of confidence did not amount to a guarantee of financial support. However, the government was sufficiently

OPPOSITE PAGE, TOP A Rolls-Royce technician works on the fan blades of an RB.211 at the company's Derby factory in the 1970s. OPPOSITE PAGE, BOTTOM Edward Heath became Leader of the Opposition in 1965, and led the Conservative Party to a surprise victory in the general election of June 1970. ALL PHOTOGRAPHS TAH ARCHIVE



ABOVE LEFT Sir Frederick Corfield, Minister of Aviation Supply during 1970-72. ABOVE CENTRE In 1970 Sir Henry Benson was appointed to lead an investigation into Rolls-Royce's finances. ABOVE RIGHT As the USA's National Security Advisor, Henry Kissinger took part in discussions with Heath about the RB.211/TriStar problem.

worried about the growing cost of civil aerospace projects, including Concorde, finally to reject launch-aid requests from BAC for its Three-Eleven airliner and decide against rejoining the Airbus project.

The collapse, when it came, was sudden and brutal. As late as December 1970 the Cabinet agreed to a request from Lockheed for a £100m Export Credits Guarantee Department (ECGD) package covering the sale of TriStars to the USA's Eastern Airlines.<sup>4</sup> But early in January 1971, even before Sir Henry could complete his review, Rolls-Royce's board concluded that the company would need nearly double the £60m granted in the November package. Programme delays also implied incurring heavy penalties under the terms of the Lockheed contract. The choice was either to abandon the RB.211 or to negotiate expensive waivers from Lockheed. The latter, unaware of the depth of Rolls-Royce's problems and still showing a misplaced confidence in the British government's commitment to the company, refused to renegotiate.

On January 29, 1971, in danger of trading illegally, Rolls-Royce declared bankruptcy. This news came as a complete shock to officials, who later claimed that they had "no prior knowledge or indication" of this "near-fatal" financial condition.<sup>5</sup> It was an even greater shock to the government, which was faced with the political fallout from what was a national and international crisis. The Cabinet decided against intervening as a necessary step to avoid an open-ended obligation on behalf of a private company.<sup>6</sup>

## DEALING WITH THE AFTERMATH

As Heath noted, "the Rolls-Royce failure will have widespread repercussions on the economy and on our defence relations with other countries".<sup>7</sup> Just before the news was to be made public, Heath personally informed President

Nixon's advisor, Henry Kissinger, of the crisis before talking to the President. He told Kissinger how "a few days ago we heard that Rolls-Royce [has] got fairly serious difficulties as far as the engine is concerned". He went on to explain how the defence interests of the company were to be acquired by the government, but the RB.211 liabilities would not be included in the new company. Heath went on to sketch out the background to the decision and the urgent need to renegotiate the Lockheed contract. He was conscious of the implications for Lockheed, which was already having difficulties delivering the C-5A military transport contract for the USAF. He was also aware that Lockheed chief Daniel J. Haughton, flying over that night from the USA, was still unaware of the impending insolvency. Asked about the future of the RB.211, Heath said, "Well, it would be possible, I suppose, to do some sort of salvage operation for Lockheed, provided there was the change in the time schedule and in the price paid for the engine".<sup>8</sup>

Later the same day Heath passed on the bad news to President Nixon. The latter had evidently been well briefed and was up to speed on the background. Indeed, he took the initiative in the conversation, having already put his Secretary of Defense, David Packard, on the case. As Kissinger put it, they had to "make the best out of a bad situation. What we really get down to is this; what our goal will be [is] some way to have Lockheed building the 'plane, flying the engine, and making a new contract and finding the financing. This is what we will try to do". If Heath could try to be as positive as possible about the future, "we will do the best we can to blunt the blow at this end".

Earlier, Heath's private secretary had telegraphed the British Ambassador in Washington DC, anticipating the call to the White House, but he had been a little less optimistic about saving the Lockheed contract; "Renegotiation might just



enable Rolls-Royce to carry on, and we might be able to salvage the RB.211, but one could not be sure of this".<sup>9</sup>

On arriving in London the Lockheed team learned of the government's actions from media reports. As Heath noted, "the disclosure of [Rolls-Royce's] position had come as a great shock to the President of Lockheed". Haughton told the British government that he could not give any assurance about the future, which would depend on Lockheed obtaining further credit. The American government was unlikely to put pressure on American banks to extend credit, and any direct help would require an Act of Congress. Kissinger had told Heath that there was little the American government could do in the short term.

The Cabinet was well aware that news of the collapse was already leaking to the press. There was no question of the government acquiring Rolls-Royce "as a going concern". However, it was agreed to keep the RB.211 going "for a limited period". There was a risk that this might imply a commitment to creditors and the risk of further commitments to support further charges, such as redundancy payments.

There was no alternative but to place Rolls-Royce into receivership and to acquire those assets relating to UK national security and commitments to allied governments. Heath told the Cabinet

**ABOVE** Daniel J. Haughton, Chairman of the Lockheed Board from May 1967, presents a model of the company's L-1011 wide-body airliner, flanked by models of two of the manufacturer's previous products – the Electra (left) and Constellation. The building of the airliner was to some extent dependent on the delivery of its Rolls-Royce engines – and vice versa.

that President Nixon had given an assurance that he would "urgently examine the possibilities of meeting our essential requirements, including means of providing Lockheed with additional finance". David Packard's prompt arrival in London on February 5 conveyed further optimism that the American government would do its best to provide Lockheed with some form of assistance, but Packard also made it clear that this would require Congressional approval.<sup>10</sup>

### **ENTER ROLLS-ROYCE (1971) LTD**

The Rolls-Royce bankruptcy, revealed publicly on February 5, 1971, was viewed as tantamount to the collapse of the Bank of England. The news that Rolls-Royce was in the hands of the Official Receiver knocked nine points off the FT index. American opinion was hardly restrained: "the sort of behaviour you would expect from an undeveloped country".

The previous day Corfield had announced that Rolls-Royce would be partly nationalised



ABOVE The prototype L-1011 TriStar, N1011, made its first flight on November 16, 1970, powered by three Rolls-Royce RB.211-22 turbofan engines. Lockheed was suffering from its own financial woes at the time, having run into difficulties with its development of the military C-5A transport and AH-56A Cheyenne helicopter projects.

as Rolls-Royce (1971) Ltd, with a 100 per cent public share ownership, to protect national security and military commitments to Britain's allies. However, the RB.211 programme and the contract with Lockheed were excluded from the new company's assets, pending negotiations with the Americans.

Apart from the initial shocked reaction to the bankruptcy, there had been no further news from the USA about assistance to Lockheed. Continuation of work on the RB.211 was costing Rolls-Royce £9m a month, and the Ministry of Aviation Supply urgently needed to know the level at which work should be sustained pending negotiations with Lockheed. The government was clear that at no point should it be implied that the engine was technically inferior to the competition, and that the financial failure of Rolls-Royce was not attributable to technical weaknesses of the RB.211. It also wanted to distance itself from any redundancies, which would be "properly laid at the door of the Receiver". The government did accept some responsibility for future employment and "the effects on our national reputation for commercial reliability if the Lockheed aircraft had to be abandoned because of our failure to deliver its engines".<sup>11</sup> But it was ready to play hardball with the Americans.

A Cabinet meeting on February 16 considered the options. Lockheed was pressing for a solution, and had received some backing from the American government, which was arguing "that

somehow the [UK] government had contrived to evade [its] obligations". This, the Cabinet was told, stemmed from a misunderstanding of British company law, which imposed "severe restrictions on both the company and the government". As a result, the government could not be rushed into resolving the situation with Lockheed.

In the meantime, some suppliers and subcontractors were refusing to supply goods to Rolls-Royce.<sup>12</sup> Nevertheless, negotiations with the Americans were becoming more intense, more so as the government became increasingly aware that Lockheed was itself in some difficulty, and that further investment in the RB.211 would have to be linked to some assurance that the TriStar would also survive. The government was aware of the need to show some willingness to be flexible over the negotiations with Lockheed, and that this should include some encouragement in Washington for a federal aid package to Lockheed. Heath determined that the government should adopt "a hard-headed approach to the forthcoming negotiations with Lockheed". This should be conveyed to the American government "in order that they might be able to consider what help, if any, American interests were prepared to offer" — a clear threat that the UK government was prepared to see Lockheed go under, with consequent damage to the USA's defence interests.<sup>13</sup>

This entailed some tough negotiations between Lockheed and the British government, not helped



ABOVE The TriStar made its UK public debut at the SBAC show at Farnborough in September 1972, the fifth production example, N305EA, being displayed in a hybrid BEA/Eastern Airlines colour scheme. The aircraft was actually one of the first batch for Eastern. The type was never operated by BEA, but did serve with British Airways.

initially by some (understandably) bitter public statements from Haughton. As the Permanent Secretary at the Ministry of Aviation Supply wrote to Sir Robert Armstrong, the Prime Minister's Secretary: "The Lockheed company has been brought near to collapse by Rolls-Royce's failure to carry out their contract and, whether or not Mr Haughton finally decides to go ahead, there will be less ill-feeling if we have meanwhile shown ourselves publicly to be understanding and helpful. If he does go ahead, we shall be under a very strong moral — and indeed quasi-legal — commitment to stand behind it. A second failure would be unthinkable".<sup>14</sup>

### ONGOING NEGOTIATIONS

The UK government's first offer to Lockheed was rejected on the grounds that the price per engine was unacceptable to the American company. In response, the government suggested to Lockheed that a "joint company" manage the engine programme. The government proposed that it would assume responsibility for work to date and that Lockheed "should bear any excess development costs". The acceptance of responsibility for all prior development costs was felt to be a major concession by the government. Taking the RB.211 through to production would cost another £91m, but it was evident that Lockheed at best could only offer an additional £50m. Any profits would be shared equally and Lockheed and the airlines would "waive all

penalties arising under the original contract for late delivery".

The government also wanted warranties from the USA for money invested from the date of the new agreement if the TriStar was cancelled. For its part, Lockheed's own problems blocked any realistic expectation that it could increase its own obligations in respect of the RB.211. Indeed, the parlous state of Lockheed's finances was so grave that the Cabinet felt that some form of financial guarantee from the American government was a prerequisite for continuing with the programme. Again, the UK government sought to influence the Nixon administration. At this stage, the gulf between the parties was described as "wide", but negotiations would continue.<sup>15</sup>

By the end of March 1971 the two sides had reached an agreement on the terms of a new contract for the RB.211. The UK government had to accept that there was a limit to how low Lockheed was prepared — or able — to go on the price of 646 engines, "because they did not have the resources to offer more, and because a further increase in price would leave the TriStar uncompetitive with its competitor, the [McDonnell Douglas] DC-10". The American government had accepted that the TriStar could not go ahead without its help. The new contract would therefore depend on Congressional approval of a \$250m loan guarantee.

For its part, the UK government would increase its share of the costs of completing engine



**ABOVE** The port RB.211-22B of a British Airways TriStar during a flight over London — Buckingham Palace is visible at lower right — after the type's entry into service with the airline in late 1974. Despite early problems with its Hyfil (carbon-fibre composite) blades and weight issues, the RB.211 finally began to deliver on its promise.

development, some £100m. However, to break with Lockheed over "a matter of £20m or £30m would adversely affect relations with the US administration and would leave the government vulnerable to severe criticism". Reluctantly, the UK government conceded that this would not be "the end of our retreat". The latter also faced the prospect of paying £2m a week while Congress debated the issue. The Cabinet felt that the offer was in effect "one which reduced the cost — at our expense — of maintaining in business a company whose survival was probably regarded as essential for American defence". As a result, the government would appreciate a "clear statement of intent from the American government" to press hard for Congress to act sooner rather than later.<sup>16</sup>

## A SETTLEMENT

In the interim, the UK government spent some £30m in the wake of the receivership on keeping the RB.211 going for the TriStar. The good news was that Congress looked like agreeing to guarantee the aircraft's development before the summer recess, despite opposition from Democratic Senator William Proxmire, a trenchant critic of "corporate welfare". The cost of delivering the engine had risen by some £20m from the March estimates, but these were now considered to be "more realistic". There was a risk that Congress might not agree to the loan before the autumn — or indeed at all. However, having renegotiated the contract, the UK government felt "honour-

bound" to fulfil its side of the bargain and accept the risk of a negative vote from Congress.<sup>17</sup>

The UK government discussed the possibility of "putting greater pressure on Congress" in order to accelerate a decision, but this would entail a threat to bankrupt Lockheed. The Cabinet opted to avoid a direct confrontation and simply convey "our concern about the delaying tactics being adopted in the US Congress on an issue of major industrial importance to both countries".<sup>18</sup>

In the event, Lockheed received the emergency loan from the American government — a measure that obtained Congressional approval in August by a single vote. As the Cabinet recorded: "The future of the RB.211 now seems assured".<sup>19</sup> President Nixon conveyed his satisfaction in a letter to Heath: "I have greeted this action by Congress with considerable satisfaction, realising the positive effect it will have on programs [sic] of importance to both the UK and the US".<sup>20</sup>

Rolls-Royce (1971) Ltd could now resume responsibility for the RB.211 programme with support from the British government worth £170m. The government had saved Rolls-Royce and what would be a key aerospace asset for the next 50 years — namely Derby's civil aero-engine expertise — but at the cost of damaged reputations all round.

With the future of the RB.211 at least stabilised, the government was prepared to accept liabilities outstanding on the Anglo-French Rolls-Royce/Snecma M45H engine used by the Dutch-German

**RIGHT** Following the drafting-in of powerplant genius Sir Stanley Hooker from retirement in 1970, the RB.211 underwent a comprehensive design review, resulting in the RB.211-524, an example of which is seen here undergoing inspection at Derby. The new variant retained the fan diameter of 89in (2.26m) but incorporated numerous significant modifications.

VFW-Fokker 614 twin-engined airliner, in part because of fears that the German government might respond by cancelling the MRCA/Tornado programme. Even if outright cancellation of the latter was unlikely, the government was hoping to negotiate a favourable share of MRCA avionics work for British companies, which had lost out to a German-led preference for an American licence-built attack-radar system. The Cabinet was also sensitive to the potential damage to the UK's reputation as a future European collaborative partner if it abandoned the M45H. This too received additional aid of £5m.<sup>21</sup>

### AND THE REST IS HISTORY?

Well, not quite — and not before another brush with financial disaster. In the immediate aftermath of the bankruptcy and bailout, the Department of Trade & Industry (DTI) felt little confidence about the long-term prospects of the RB.211; in a note prepared in the spring of 1973, officials felt the engine to be like Concorde — "a programme of doubtful economic justification, but which for political reasons and because of the chaos [that] dropping it would cause, will remain with us for a very long time".<sup>22</sup>

By the late 1970s, however, Boeing had selected variants of the RB.211 as options for its new 757 twin-engined airliner and a development of the 747. Commercially at least, things began to pick up. Unlike the ill-fated deal with Lockheed, this was perhaps the breakthrough supplying the world's market-leader. There was no problem technically with either of the engine variants for the 757 and 747, but the contract had exploited the then-weakness of sterling to set a price. Acting on the advice of the Bank of England and the



Treasury, Rolls-Royce chose not to hedge against any strengthening of sterling against the dollar.<sup>23</sup>

In 1979, buoyed by the growing revenues generated by North Sea oil and the Thatcher government's high-interest-rate policies, sterling went from \$1.80 at the time of the signing of the Boeing contract to \$2.30, with serious consequences for Rolls-Royce's finances. That year Rolls-Royce declared a pre-tax loss of £58.4m, largely to the dollar-priced Boeing contracts. The effect of this crisis was again embarrassing to the government: although Rolls-Royce (1971) Ltd was "owned" by the National Enterprise Board (NEB), a holdover from the Labour government of the late 1970s, there was some ambiguity over

*In June 1977 British Airways became the first airline to take delivery of the RB.211-524-powered Boeing 747, the famous Jumbo having been powered by American Pratt & Whitney JT9Ds up to that point. Qantas followed suit, having discovered that British Airways' RB.211-powered 747s burnt some seven per cent less fuel than its JT9D-equipped fleet — a saving of about \$1m per year per aircraft.*



1 Hayward, K., *Government and British Civil Aerospace*, Manchester University Press, 1983, Chapter 4. This chapter was largely based on the 1973 DTI report *Rolls-Royce Limited; an investigation under the Company's Act* by R.A. MacCrindle and P. Godfrey, which had full access to government and company papers; this article now benefits from access to the government papers lodged at The National Archives (TNA), Kew, London

2 Minutes of Cabinet meeting, October 14, 1970, TNA ref CAB 128/47/30

3 Minutes of Cabinet meeting, October 19, 1970, TNA ref CAB/128/47/31

4 Minutes of Cabinet meeting, December 10, 1970, TNA ref CAB 128/47/45

5 MacCrindle, R.A. and Godfrey P., *op cit*, para 481

6 Hayward, *op cit*, pp113–115

7 Note to Cabinet from Prime Minister, February 5, 1971, TNA ref CAB 129/155/18

8 Transcript of telephone conversation between Prime Minister Heath and Henry Kissinger, February 1, 1971, TNA ref PREM15/229

9 *Ibid*; also telegram to British Ambassador, Washington DC, from Sir Robert Armstrong, Secretary to the Prime Minister, February 1, 1972; TNA ref PREM 15/229

10 Minutes of Cabinet meeting, February 4, 1971, TNA ref CAB 128/49/7; also Minutes of meeting with US Defense Secretary David Packard, February 5, 1971; TNA ref PREM 15/229

11 Minutes of Cabinet meeting, February 9, 1971, TNA ref CAB 128/49/9

12 Minutes of Cabinet meeting, February 16, 1971, TNA ref CAB 128/49/10

13 Minutes of Cabinet meeting, February 25, 1971, TNA ref CAB 128/49/11

14 Note from Cabinet Secretary to Prime Minister, February 10, 1971, TNA ref PREM 15/229

15 Minutes of Cabinet meeting, March 4, 1971, TNA ref CAB 128/48/12; also Minutes of Cabinet meeting, February 25, 1971, TNA ref CAB 128/49/17; Technical note by officials, "RB.211", March 26, 1971, TNA ref CAB 129/156/16

16 Minutes of Cabinet meeting, March 4, 1971, TNA ref CAB 128/48/12; Minutes of Cabinet meeting, February 25, 1971, CAB 128/49/17; Technical note by officials, RB.211, March 26, 1971, CAB 129/156/16; Minutes of Cabinet meeting, March 29, 1971, CAB 128/49/18

17 DTI memorandum, July 26, 1971, TNA ref CAB 129/158/18

18 Minutes of Cabinet meeting, July 28, 1971, TNA ref CAB 128/49/42

19 Minutes of Cabinet meeting, August 3, 1971, TNA ref CAB 128/49/43

20 Letter from President Nixon to Prime Minister Heath, August 17, 1971, TNA ref PREM 15/229

21 Cabinet minute, August 3, 1971, TNA ref CAB/129/158/22; "The M45H Engine", a memorandum by the Secretary of State for Trade and Industry, July 30, 1971, TNA ref CAB/129/158/22. The VFW 614 was Germany's first post-1945 indigenous airliner; it was not a commercial success

22 *The European Airframe Industry — the Project Basis for the Industry and Possible Initiatives*, DTI Note, April 1973, TNA ref AVIA 65/2349

23 *Ibid*, pp202–208

24 *Ibid*; my thanks to David Marshall for his memories of the 1980s

the degree to which it had responsibility for the company's commercial decisions. Fortunately, by the summer of 1981, the "sterling crisis" began to ease as the pound dropped back to \$1.90, the upper limit Rolls-Royce had set for comfort in the Boeing contracts. Learning from this experience, Rolls-Royce would in the future "hedge forward" (i.e. set the price on a future sterling/dollar valuation) to mitigate its currency risks.<sup>24</sup>

In the longer term, Rolls-Royce and its increasingly successful family of three-shaft civil aero-engines would eventually emerge from public ownership under the Thatcher government in 1987. The sale raised £1.36bn, with the government retaining a "golden share" to prevent a foreign takeover. The company went

on to consolidate its position as one of only three global manufacturers of large civil aero-engines.

In the 1980s there was a possibility that American manufacturer General Electric might acquire the company, but this chance passed with the death of the then-Rolls-Royce Chairman Sir Denning Pearson. By the early 21st Century, it would be a transnational aerospace company with important investments in the USA, Singapore and Germany.

Lockheed would also prosper, and, as part of Lockheed Martin, is now the world's largest defence contractor — its foray into civil aviation long forgotten. But 50 years ago, Lockheed (and Rolls-Royce as a civil engine maker) only survived by a single Senatorial vote — a "damn close-run thing" for both companies.

**BELOW** In the 1980s the RB.211 evolved again to become the RB.211-535, which was selected by Boeing to power its 757 narrow-body medium-range jetliner, the first time the British company had supplied a launch engine on a Boeing aircraft. Variants of the RB.211-535 went on to power Boeing's 767 and the Russian Tupolev Tu-204 airliner.

MIKE HOOKS





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# ROVER DAVID

## CLOSE AIR SUPPORT IN THE SECOND WORLD WAR – PART ONE

Based on research for his newly published book *Close Call*, VIC FLINTHAM opens a two-part series on the evolution of the Allies' Rover system of air support for ground troops in North Africa and later Italy, in which small cadres — or "cab ranks" — of fighter-bombers could be called in at short notice to attack enemy targets as they arose on the battlefield



*Until the advent of the Curtiss Kittyhawk in theatre the Hawker Hurricane bore the brunt of fighter cover and strafing duties in North Africa. Here Hurricane Mk IIB Z2679 is simply coded "QJ" and is believed to have been used by No 92 Sqn in mid-1942 to support working-up in the Western Desert.*



**T**HIS ARTICLE WAS written during the 80th anniversary of the British withdrawal from Dunkirk. To this day there remains controversy as to the role of the RAF in covering the evacuation — “where was the RAF?”. It was there, of course; but, by the nature of air warfare, rarely visible to troops on the ground. But from El Alamein in October 1942 onwards there was never a battle in the Mediterranean theatre in which the junior service was not only visible but, more importantly, highly effective.

### THE PRIMACY OF AIR SUPERIORITY

In 1942 Air Vice-Marshal (AVM) Sir Arthur Coningham described his priorities for success in the use of tactical air power: “First, gain air superiority. Second, use the air superiority gained to interdict enemy reinforcements of men and materiel to isolate the battlefield. Third, combine air attacks with ground assaults on the front lines”. Coningham’s policy was pursued throughout the war in the Mediterranean theatre, but the seeds for close co-operation between air and ground forces were sown in East Africa in 1941.

Supporting the British Army fighting the Italians in Ethiopia, Air Cdre Bill Sowrey’s No 203 Group comprised mostly South African and Rhodesian squadrons flying mainly obsolescent biplane types. During an assault in the spring by 22 (East Africa) Brigade, a Close Support Flight of four Gloster Gladiators and four Hawker Hartbees covered the advance directed by a forward controller at the Brigade’s forward HQ. The Flight often operated orbiting the front line waiting for a call; thus the “cab rank” was born.

Up until October 1942 the Axis forces had

largely had the upper hand in the Western Desert, having pushed the British Eighth Army back into Egypt. With the attack out of El Alamein in October, the tide turned and for the first time troops on the ground were provided with close air support from the RAF. The Western Desert Air Force (WDAF) was comparatively well-equipped. The main fighter type in service was the Hawker Hurricane, of which there were eight squadrons in two Wings, plus five specialised Tactical Reconnaissance (Tac/R), tankbuster and intruder squadrons. There were three squadrons of newly arrived Supermarine Spitfire Mk Vs and two Wings of Curtiss fighters — one Tomahawk and seven Kittyhawk squadrons — with three USAAF P-40F squadrons from the 57th Fighter Group (FG) attached.

Only the Kittyhawks carried light bombs, with the other non-specialised fighter units providing cover, both for offensive fighters and bombers, and over advancing troops to fend off any air attacks on them. Most of the close support sorties were managed by light bombers, of which there were two RAF squadrons of Douglas Bostons, three of Martin Baltimores and four of USAAF North American B-25s.

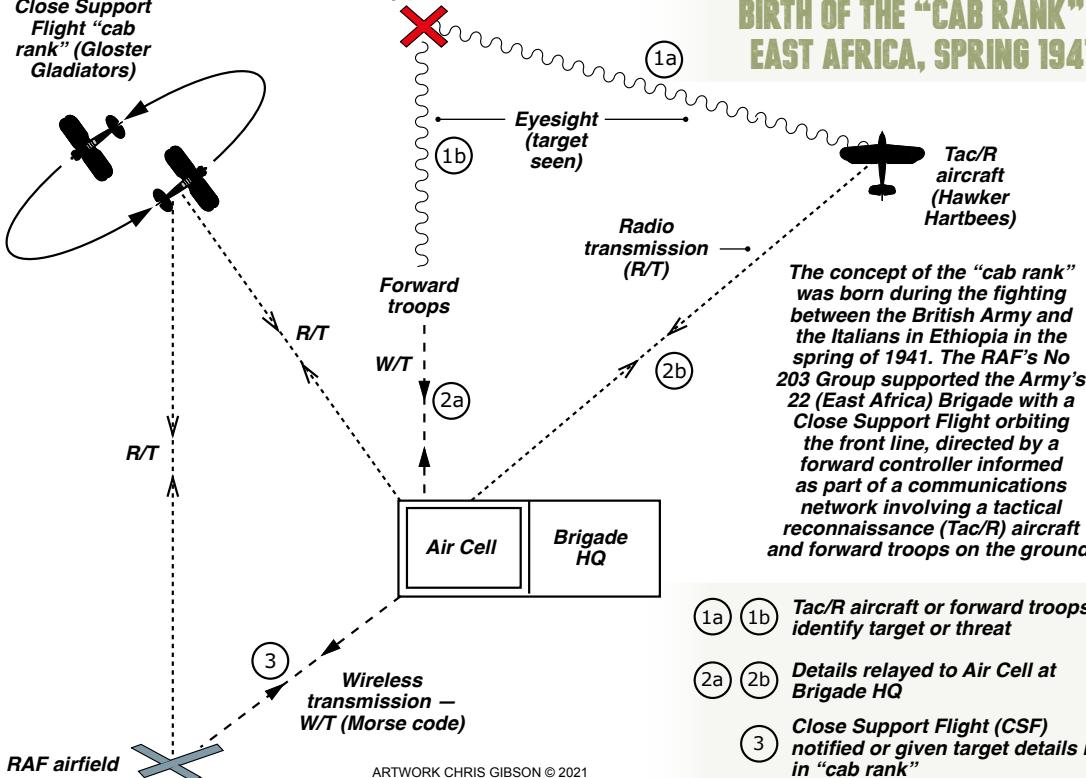
There were several key features of the arrangements that were to carry through to later systems and act as the basis for immediate support on tap. First, the senior commanders had co-located forward HQs and were mutually briefed. Key brigades had forward observation posts, or tentacles, with links straight back to an Army Air Support Control (AASC). There was usually a Tac/R fighter up over the front and the tentacles were able to monitor its calls. Any request for

**OPPOSITE PAGE, BOTTOM** As seen in this coloured photograph, taken at Sidi Haneish in July 1941, the Curtiss Tomahawks of No 112 Sqn took advantage of the type’s distinctive chin radiator to apply sharkmouth markings. The unit had exchanged its Gladiators for Tomahawks the previous month. Colour by RICHARD JAMES MOLLOY.

**Close Support**  
Flight "cab rank" (Gloster Gladiators)

**Enemy position**

## BIRTH OF THE "CAB RANK", EAST AFRICA, SPRING 1941



The concept of the "cab rank" was born during the fighting between the British Army and the Italians in Ethiopia in the spring of 1941. The RAF's No 203 Group supported the Army's 22 (East Africa) Brigade with a Close Support Flight orbiting the front line, directed by a forward controller informed as part of a communications network involving a tactical reconnaissance (Tac/R) aircraft and forward troops on the ground.

(1a) (1b) Tac/R aircraft or forward troops identify target or threat

(2a) (2b) Details relayed to Air Cell at Brigade HQ

(3) Close Support Flight (CSF) notified or given target details if in "cab rank"

ARTWORK CHRIS GIBSON © 2021

support would come straight from the tentacle to AASC, quickly considered in the context of the overall battle plan and current situation and then, if agreed, referred straight back to one of the fighter or bomber wings for action. The response time overall from call to bombs dropping was around 90min.

The break-out from El Alamein succeeded in part because the WDAF had secured a degree of air superiority and had managed, in combination with the Royal Navy, a very successful interdiction programme that severely limited supplies to Generalfeldmarschall Erwin Rommel, the German commander. It also succeeded because the senior commanders treated one another as equals and because with a good leavening of Dominion aircrew — many South African — there was a no-nonsense "can-do" approach at squadron level. Indeed, some squadrons operated combined aircrew mess regardless of rank. At the highest level the Commander-in-Chief, Middle East Command, Gen Sir Harold Alexander, got on well with Air Chief Marshal Sir Arthur Tedder, Air Officer Commanding (AOC) RAF Middle East Command; and Lt-Gen Sir Bernard Montgomery, Eighth Army, shared advanced headquarters with Coningham, AOC Air HQ Western Desert, their relationship at this stage — before egos got in the way — working to mutual advantage.

The final significant battle in North Africa, at El Hamma in Tunisia, began in late March 1943, by

which time there had been a reorganisation of the Allied air forces. [For Dr Andrew Arthy's two-part series on the air battle over Sidi Bou Zid in February 1943, see Two Days in February in TAH32 and TAH33 — Ed.] General Dwight D. Eisenhower had been appointed Supreme Allied Commander with Alexander as his deputy and Tedder as the AOC Northwest African Air Forces (NAAF). Within Tedder's command were strategic, coastal, transport and tactical air forces, the latter under the command of Coningham. Within the Northwest African Tactical Air Force (NATAF) were three subordinate commands including the WDAF, now under the command of AVM Harry Broadhurst, who had been Coningham's Senior Air Staff Officer.

### CLOSE AIR SUPPORT AT EL HAMMA

During the Eighth Army advance from Libya into Tunisia, Montgomery had been blocked on the Mareth Line, a system of fortifications built by France in southern Tunisia in the late 1930s. He thus decided to bypass it by driving the New Zealand Corps, with the 1st Armoured Division, inland and up to the Tebaga Gap near El Hamma. The assault on the Gap was due to start on March 26 and was preceded by days of bombing Axis troops, guns and tanks. Broadhurst now decided to ignore Coningham's aforementioned priorities and provide immediate air support and cover



ABOVE LEFT Air Vice-Marshal Sir Arthur Coningham served as AOC Air HQ Western Desert during 1941–43. ABOVE CENTRE Air Chief Marshal Sir Arthur Tedder was appointed AOC RAF Middle East Command on June 1, 1941. ABOVE RIGHT Air Vice-Marshal Harry Broadhurst took command of the Desert Air Force in January 1943.

over advancing troops. For this to be effective he placed several pilots among the forward observation post tentacles in direct contact with circling fighters.

There were precise plans for marking the bomb line — a notional line just ahead of the front line of advancing troops. As the troops met resistance, the fighters were called in to bomb and strafe. The advance succeeded, the Army was delighted and Broadhurst was severely rebuked. The Wing most heavily involved was No 239 Wing with five Kittyhawk squadrons, two of them Australian: its CO was Wg Cdr G.D.L. Haysom.

David Haysom was a South African Battle of Britain veteran, a man modest to a fault and an all-round athlete blessed with extremely good powers of communication, which supported his diplomatic skills. His intelligence, experience and credibility enabled him to grasp the significance of El Hamma and start a process of refinement that led eventually to the most extensive close air support operation of all time. The developments took place in Italy, and after the invasion of Sicily in July 1943 Haysom was promoted Gp Capt and became Senior Air Staff Officer (SASO) Desert Air Force (DAF), a position that gave him wide access to commanders and squadrons.

The use of aircraft in close support was always intended to complement artillery. However, there

were situations when air support was either the better — or perhaps the only — option. There were times when targets were inaccessible to artillery, either in a rapid advance or in terrain where geography and climate made finding a suitable site for guns impossible. There were also situations in which the number of targets outweighed the number of guns available, where there was an acute shortage of shells, or where there were fleeting targets better tracked and attacked from the air. There were also occasions when it was desirable to bring a weight of bomb and shell continuously on to a target; typically enemy troops massing.

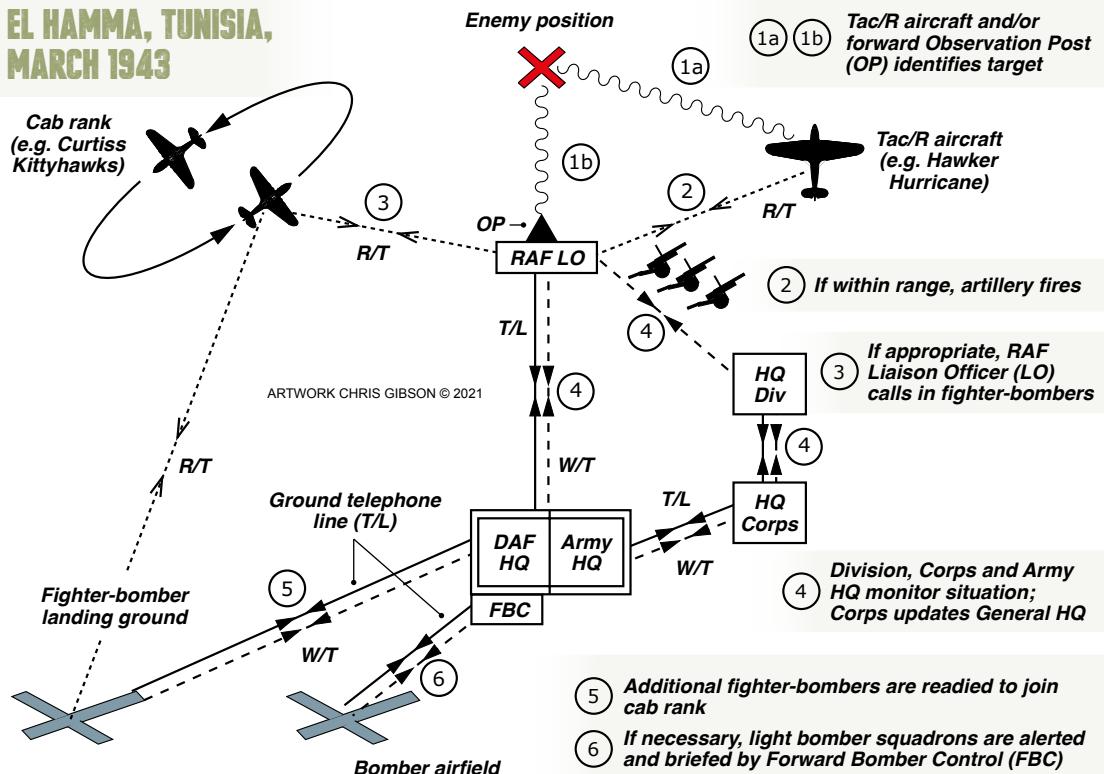
Artillery was organised such that divisions were nominally allocated three field regiments, with further field and medium or heavy regiments being retained at Corps and Army level for allocation as the respective commander deemed necessary. These heavier guns were normally organised within an Army Group Royal Artillery (AGRA). Field regiments consisted of 24 x 25-pounder guns in three batteries of eight, each in two troops of four guns. Heavy regiments consisted of 16 guns in four batteries of four.

Artillery operated with observation posts either on the ground or in the air. Throughout the war in Italy there were air observation post (AOP) squadrons flying Auster light aircraft allocated to

*The Kittyhawk entered RAF service with No 250 Sqn in April 1942. The type proved to be a robust close-support aircraft, although less effective as an air-superiority fighter. Carrying 250lb (110kg) bombs on their centreline pylons, a group of "LD"-coded Kittyhawks of No 250 Sqn line up to take off on another sortie.*



# EL HAMMA, TUNISIA, MARCH 1943



Corps. These squadrons comprised 20 aircraft in four flights of four (plus four in reserve). The HQ Flight undertook little shooting, while the three lettered flights were each allocated to a division. The flights were subdivided into sections (of one aircraft and pilot), each allocated to a medium or heavy battery or AGRA.

The main function of the AOP pilots — invariably Royal Artillery Officers of captain rank — was to shoot guns. They had considerable authority and could order both the number of guns on to a target and the scale, or volume of shells, per gun. Their orders were rarely countermanded; when they were, it was most likely that the local Commander Royal Artillery (CRA) would order either more guns or a heavier scale. Shoots were of the following type:

- calibration — to support gun sighting;
- registration — to align gunfire to a specific target;
- general — against, for example, infantry;
- destructive — to destroy some tangible item;
- neutralisation — to ensure that the target, typically a gun, was incapable of firing for the duration of an assault;
- counter-battery — to destroy enemy guns;
- sustained fire — continuous on a restricted target;
- experimental — for example, shooting tanks.

The nature of targets would determine the level of gunfire. Those targets meriting fire from a battery were lettered from P-Peter to

T-Tare. Targets meriting fire from a regiment were M-Mike, a division U-Uncle and an AGRA Y-Yoke. In addition, the AOP units flew liaison and reconnaissance sorties, contact sorties to determine generally the position of friendly troops, and location sorties to identify the position of enemy troops, artillery, motor transport vehicles (M/T) or tanks.

## THE SANGRO BATTLE AND ROVER DAVID

Although the AOP squadrons had been active in North Africa, Sicily and Salerno, the Battle of the Sangro River during November—December 1943 was the first time in which they played a comprehensive role, integrated with their Corps and divisions. It was also the first occasion on which the comprehensive close air support system was applied.

After the invasion of Sicily the Allied armies had made cautious progress through Italy beyond Naples and the Foggia Plain, the latter with its extensive airfields. The armies were now astride the Apennine mountains with winter approaching and with rivers presenting formidable barriers every 15 miles (25km) or so. The Eighth Army was on the eastern (Adriatic) side and had crossed the Trigno River by October 22. The scene was now set for vicious fighting across the next river, the Sangro. The German defensive line, known as the Bernhardt Line, ran for 45 miles (72km) from Alfedena, high in the mountains, to the coast along the river and was



**ABOVE** Air Observation Post (AOP) Austers initially played a complementary role to close air support, guiding artillery where targets were within range. They operated in detached flights, each of four aircraft, one aircraft and pilot being a section: A (numbered 1–4), B (5–8), C (9–12) and HQ (13–16). This Mk III flew with B Flt, No 655 Sqn.

heavily defended by three German divisions, well dug in, and with both banks of the river mined.

When weather permitted, the aircraft of the DAF bombed and strafed German positions. D-day for the attack on the line was postponed owing to appalling weather; but, with some tentative crossings already made, the assault proper began on November 28. Haysom's scheme was now about to play a key part, centred on a roving air controller, callsign *Rover David*.

Here is how it worked. Each evening there was a conference at DAF HQ comprising the SASO, Gp Capt and Wg Cdr Operations, Wg Cdr Intelligence and their Army counterparts. Discussion about the day's events would lead to the following day's intentions and challenges, which would result, *inter alia*, in an agreed target list for the fighter-bombers and light bombers of the DAF. At the same time it would be agreed with which observation post tentacle(s) the RAF *Rover* officer(s) would be based. The tentacles were forward elements of (usually) infantry brigades and AGRA and were ideally, but not essentially, within view of the intended target(s).

Key to planning was the Army Air Support Control (AASC), staffed by Army air liaison officers (ALOs), which by 2300hr relayed the requirements for air cover — as determined by DAF and Army HQ, and specific standby targets — to the Mobile Operations Room Unit (MORU). This organisation was responsible for allocating all manner of tasks to all elements

of tactical and coastal air forces, so was aware of squadron status and prior commitments. In respect of the *Rover* system, Wings then delegated missions to squadrons. The latter were required to provide flights of six aircraft at specific times to patrol over the front. The fighter-bomber units were thus allocated 20min slots and locations for the following day by MORU and briefed on potential standby targets. The timing of each cab rank and its callsign were notified in advance to the tentacle(s). As noted above, each flight was allocated a standby target for attack in the event that the aircraft were not called in for a spontaneous attack. This was the "alternate".

The key air formation was the cab rank, at this stage of the war the flight of six aircraft allocated to cover the critical part of the front line. The cab rank was on task for 20min, and below on the ground, with a leading tentacle, was *Rover David* (presumed to be named for Haysom). The control was based in a White scout car fitted with HF and VHF radio, but as time went by more suitable vehicles were used. Tanks were tried with limited success, but later *Rover* used a jeep with radio equipment and support personnel in a quad and trailer. Personnel comprised the RAF controller, an ALO, RAF radio mechanic and R/T operator and an Army R/T operator. The ALO was in contact with brigade HQ and the gunners.

Once on station the cab rank leader was to make contact with *Rover David* and then, the aircraft flying line-astern, wait for a target. All forward



**"THE NO 112 SQN  
ORB RECORDS:  
'ALL BOMBS  
OBSERVED IN  
TARGET AREA.  
GROUND CONTROL  
REPORTING  
'EXCELLENT  
SHOW' . . . "**

LEFT Italy's central Adriatic coast circa late 1943. The locations marked with white circles represent Allied airfields. Map by MAGGIE NELSON

tentacles were able to maintain a listening watch on the cab rank. If after 20min there was no immediate obstacle to attack, the flight was released to attack its alternate and immediately replaced by the next cab rank. Spontaneous targets were attacked by pairs of aircraft with sufficient interval for *Rover David* to make any corrections. Information could be instantly updated and details added by the flight commander observing the intended target from the air.

The system was described as *Rover* because the air controller was highly mobile and could quickly locate to that part of the front likely to be in need of air support. To work cost-effectively and safely the system relied on the following: air superiority; shared planning; a clear bomb line; an alternate target, so that no mission was wasted; ground control in immediate contact with the cab rank and ground forces, and shared area maps.

On November 29 No 112 Sqn RAF flew its first true *Rover David* mission, as noted in the unit's operational record book (ORB). Six Kittyhawks departed Mileni at 0900hr to orbit Fossacesia.

At 0935hr *Rover* control called them on to a target south-west of the village at G.3804. Dive-bombing was from 8,000–1,000ft (2,400–300m) and the aircraft were back on the ground by 1005hr. The ORB records: "All bombs observed in target area. Ground Control reporting 'Excellent show'". Four further *Rover* missions were flown by the squadron that day, each of six aircraft, and each having a specific area to orbit. Thus there were missions departing Mileni at 0920hr, 1215hr, 1235hr and 1500hr. The average sortie time was 1hr 15min; three of the missions were not called in, so bombed their pre-briefed alternate targets. The 1235hr mission was called in to a target a mile (1.6km) south-west of a convent, the ORB recording: "Leader and his No 2 bombed and was told target lay 200yd further from bomb line. He therefore strafed area and remaining aircraft bombed. Four bombs observed in target area".

Four further *Rover* missions were flown by No 112 Sqn on the 30th. During one of these the six Kittyhawks were called on to a target, while the other missions attacked the alternate target.

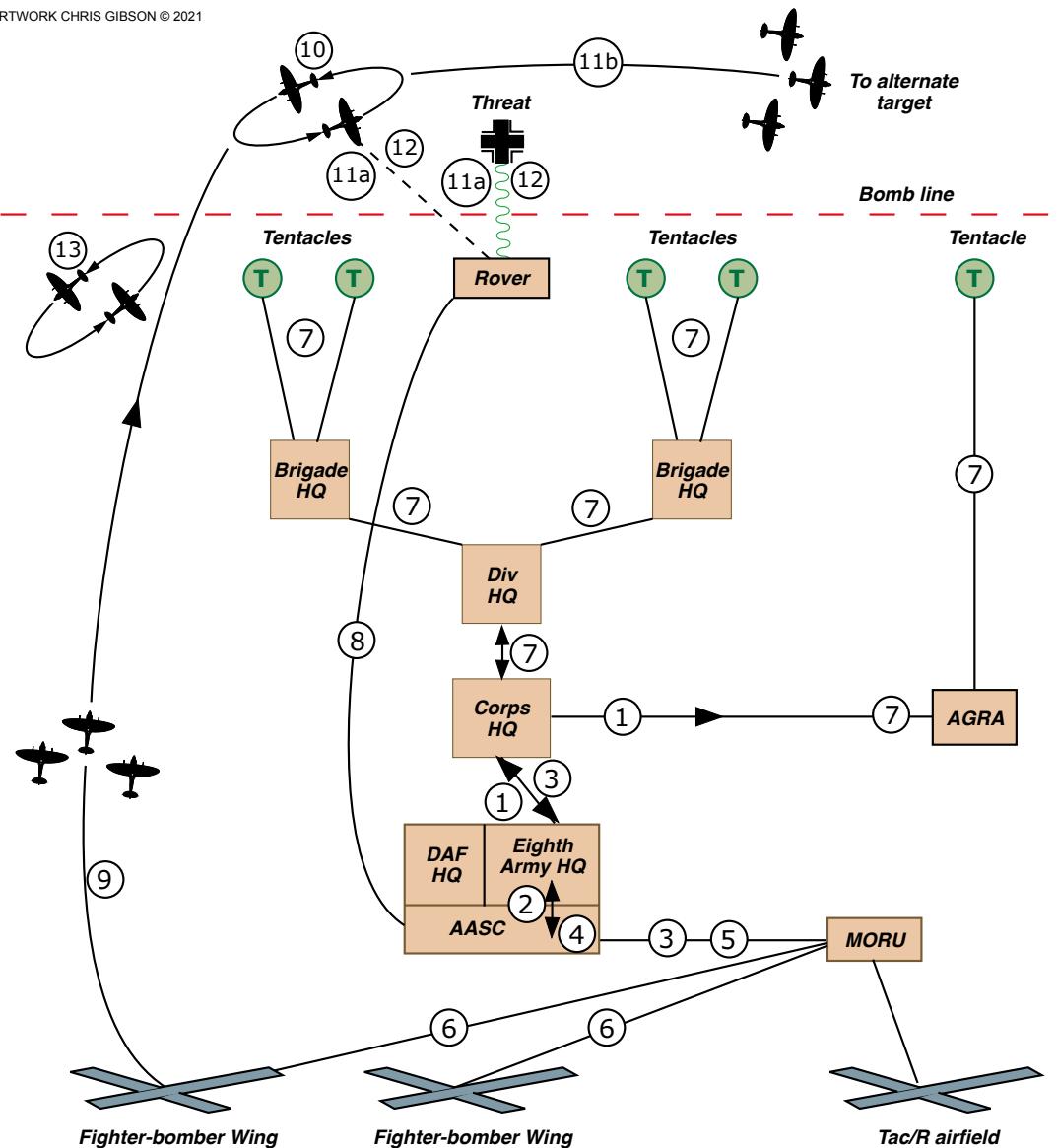
*The RAF's No 112 Sqn was also an early recipient of the Kittyhawk Mk I, equivalent to the USAAF's P-40D. The unit's "GA" code and sharkmouth markings are clearly visible in this photo of AL225/GA-T armed with a single 250lb bomb. Later marks carried up to 2,000lb (905kg) of bombs, albeit when stripped of some navigation kit.*



# SANGRO: THE FIRST FULL ROVER SYSTEM, NOV-DEC 1943

This diagram shows the increased complexity — but far greater effectiveness — of the Rover system, in this case dealing with cover support for an uncertain enemy threat, first used during the Battle for the Sangro River during November—December 1943

ARTWORK CHRIS GIBSON © 2021



- 1 Likely threats agreed between Army HQ and Corps and Army Group Royal Artillery (AGRA) . . .
- 2 . . . discussed and agreed with Army Air Support Control (AASC)
- 3 Tac/R unit notified with request for target photos
- 4 AASC determines alternate targets
- 5 Mobile Operations Room Unit (MORU) notified with details by 2100hr
- 6 MORU allocates to Wing, which allocates to squadron(s)
- 7 Plan notified back down the command chain and to AGRA
- 8 Rover David alerted and in place
- 9 Squadron(s) despatch fighter-bombers for cab rank
- 10 Fighter-bombers contact Rover David and orbit the front line for 20min
- 11a If immediate threat, cab rank called in
- 11b If no call within 20min, cab rank relieved to attack alternate target
- 12 Attack monitored by Rover David and modified if necessary
- 13 Cab rank Flight replaced after 20min



## GROUP CAPTAIN DAVID HAYSON

GEOFFREY DAVID LEYBOURN Haysom was born in Durban, South Africa, on October 20, 1917. After reading Science at Natal University College he went to Edinburgh to study medicine. He left the course early to take a short-service commission in the RAF, learning to fly at No 2 Flying Training School at Brize Norton in June 1937. His first posting was as a staff pilot to the School of Naval Co-operation at Ford. Through the Battle of Britain he claimed five German aircraft destroyed, one probable and two damaged. He became OC No 79 Sqn and was then posted to the Middle East as OC No 239 Wing, the first dedicated fighter-bomber Wing, with the acting rank of Wg Cdr at the age of 23. In the summer of 1943 he was appointed Gp Capt and served as Senior Staff Officer with the Desert Air Force in Italy. In 1944 he married Antoinette Becket. VF

The system was not closed, in that it also depended on a widely shared, but secure and up-to-date, appreciation of the battlefield. Thus the role of the tactical reconnaissance squadrons was key in securing up-to-the-minute photographs, which were then processed and gridded.

### FROM MAPS TO PHOTOGRAPHS

Initially briefers, pilots and *Rovers* would be using the same gridded maps, first 1/250,000, but soon changed to 1/100,000. The grids were rectangles representing 400m x 500m, numbered from south to north and lettered west to east. However, while essential for navigation, maps had limitations for speedily identifying a precise location near the front line. In due course oblique photographs were used most effectively. The unique solution was the Merton gridded oblique photograph.

The photographs were taken at the request of the Artillery Commander, who specified the location, required height and whether over or behind the front line. (For counter-battery work there would usually be a requirement for the frames to be shot from 3,000ft — 900m — behind the line to include the Allied battery.) Ideally, infra-red film was used to cut through haze and the F24 camera was set at 12°. The photographs, taken in large numbers from early 1943, were secured by Tac/R aircraft of No 285 Wing at low level and processed and copied by No 3 Mobile Field Photographic Section (MFPS) during the Sangro battle, at Foggia and Triola.

The oblique photographs, taken a second or two apart and thus similar but not the same, first had

the plumb points identified before being given a striated grid numbered from front to back 10 to 30 and from left to right also from 10 to 30. Each was numbered, dated and indicated the height and direction faced, and usually included the horizon.

These photographs were much easier to read in the air than maps or charts and were always current. When a *Rover* controller needed to call up a cab rank for an urgent target he would be using the same Merton oblique as the pilots and the local battery commander, and would simply confirm the number and the grid and then give a brief explanation of the specific target.

The first Merton photographs to be produced for operational use were taken from a No 225 Sqn Hurricane in April 1943 in Tunisia for artillery application by No 651 Sqn. The Battle of the River Sangro is understood to be the first time that the Merton gridded oblique photographs were used operationally by artillery, AOP and fighters concurrently, although there is reference in ORBs to the use of maps.

Up to this point in the war the aircraft applied to the close air support role had been designed and built as air superiority fighters or light bombers. Similarly, the pilots had been trained for interception, escort or day-bombing tasks and had been forced to develop new tactics in response to changing demands.



**NEXT TIME** The author concludes his two-part series with the further development of aircraft for the *Rover* David system and the continued evolution of David Haysom's innovative use of tactical air power

*By the time Supermarine Spitfire Mk V JK446/GN-B of No 249 Sqn was photographed at Catania, Sicily, in late 1943, the type had lost the Vokes chin-mounted tropical filter fitted for action in North Africa, and was being used in the close-support role.*

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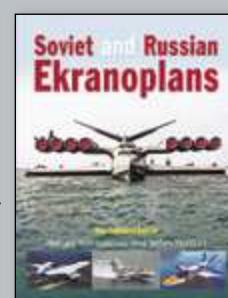
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# FRANCE'S AIR PIONEERS: RAYMOND D'ECQUEVILLY

French aviation historian **JEAN-CHRISTOPHE CARBONEL** continues his series on "those magnificent Frenchmen" who risked their reputations, fortunes — and often lives — to further the cause of aviation across the Channel. This time: the brief foray into aeronautics of the controversial submarine designer Raymond d'Ecquevilly, who built two oddball flying-machines

**O**F THE AIRCRAFT often used to illustrate the creativity — or delirium — of the early pioneers of aviation, the extraordinary multiplanes created by France's Marquis d'Ecquevilly-Montjustin (RIGHT) are frequently top of the list. The Marquis himself was a controversial character whose dealings with aviation were limited to a period of two years — 1908–09 — the rest of his career being devoted to the design of submarines.

## A LIFE OF CONTROVERSY

Raymond Marquis d'Ecquevilly-Montjustin (or Raymond d'Ecquevilly for short) was born in Vienna on July 22, 1873, to a French mother and a Spanish father — Victor Toussaint Vincent d'Ecquevilly-Montjustin, a native of Ecquevilly (with an e) in Haute-Saône (near Dijon in France), but who was ennobled in Spain in 1879. Raymond was therefore technically born a Spaniard, but became a naturalised Frenchman in 1914.

After completing his studies in Paris in the 1880s d'Ecquevilly became a naval engineer and was recruited by the *Forges et Chantiers de Méditerranée*, where he learned his trade under renowned French submarine designer Maxime Laubeuf. During 1895–99 d'Ecquevilly worked at the Vulkan shipyard at Stettin in Prussia, to which he travelled often from France. Considering this was one of the worst periods in Franco-Prussian relations, it is somewhat surprising that a French engineer was able to work in such a security-sensitive area as military submarines. Whether d'Ecquevilly had access to military secrets is unknown, but in 1901 he wrote a book on the subject, *Les bateaux sous-marins et les submersibles*, in which he revealed what the French considered technical secrets, thus facing allegations of being *un traître* in France.

To make matters worse, in 1902 d'Ecquevilly offered to build a new military submarine for



VIA AUTHOR

the French, but an examination of his drawings convinced *Amiral Marc Gilbert Paul Hautefeuille* that d'Ecquevilly had stolen and plagiarised the designs of Loubet and Laubeuf, at that time leading submarine designers in France. As a result, d'Ecquevilly returned to Stettin, where he accomplished his major work — designing the first German military submarine, U-1. It was later rumoured at the end of the First World War that he had sold submarine blueprints "inspired" by the designs of Loubet and Laubeuf to German company Krupp in 1905, the transaction being conducted in a Geneva hotel.

With the outbreak of the First World War d'Ecquevilly enlisted in the French Army (possibly in connection with his obtaining French nationality) and was assigned to an armoured car company. Later, he was reportedly sent on a "secret mission" to the UK by the



*A fine photograph of d'Ecquevilly's first flying-machine in the summer of 1908, probably in the Parc de Bagatelle in the Bois de Boulogne in Paris, the same location at which Santos-Dumont had tested his 14bis in October 1906.*

*Ministère de la Marine* (French Naval Ministry), but the affair of the stolen submarine blueprints resurfaced and the mission failed.

In May 1918 d'Ecquevilly was again in the spotlight regarding the stolen blueprints and was briefly arrested, but it seems the whole thing ultimately petered out and he died on September 21, 1925, at the age of 52.

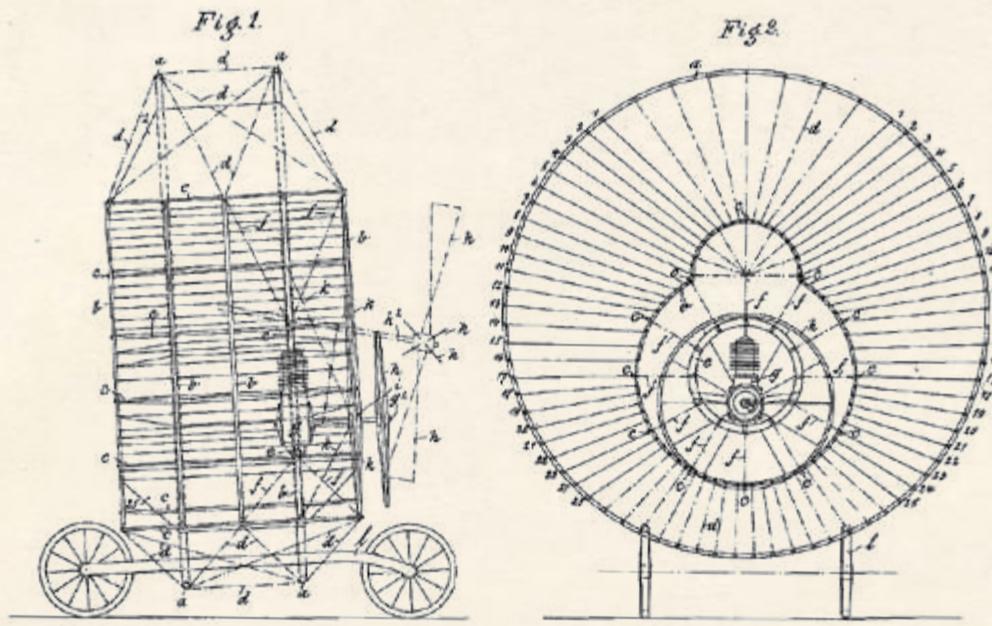
### ATTEMPTS AT AVIATION

On August 19, 1908, at this point living in Kiel in northern Germany, d'Ecquevilly applied for an aircraft patent in the UK, France and Germany. It was his first aviation-themed patent after more than 50 dealing with submarines. It described "a flying-machine, the framework of which consists of two or more circular or oval-shaped rings or hoops of thin steel tubing, bamboo or the like, which are connected or braced horizontally

by means of thin steel wires or the like, [and in] which rings or hoops are likewise braced together horizontally. In the space between the outer and inner rings are fixed at both sides a large number of separate sail surfaces". The idea behind this curious arrangement was to "enable the greatest possible total sail surface to be obtained in the smallest possible space".

Another proposed advantage was to suspend the engine "elastically", so as to distribute equally any vibration over the whole airframe, and to enable the machine to resist any shock: "Any blow sustained in landing or by falling of the machine shall not be transmitted directly to the motor or the air navigator".

Compactness and security were key elements of the design — a parachute was to be stored at the top of the circular frame in case of engine failure — but d'Ecquevilly also incorporated



ABOVE This pair of figures, from d'Ecquevilly's 1908 patent, provide details of his first flying-machine, which incorporated 50 half-planes arranged in a circular frame, wheeled chassis, 8 h.p. Buchet engine and adjustable propeller shaft. It was built in Paris but it certainly never flew — indeed it would not have been capable of doing so.

another idea into his aeroplane; the propeller shaft could be tilted at will to "increase or decrease at pleasure the upward driving or lifting effect".

It appears that the patent relates to d'Ecquevilly's first aircraft, construction of which was almost certainly complete when the patent was applied for. French aviation periodical *l'Aérophile* reported in its issue of June 15, 1908, that "a fire has destroyed at the Garage Carreau in Paris an aeroplane being built for a M Ecquevilly [sic]. Only the engine, a three-cylinder 12 h.p. Buchet, is salvageable". That the machine is described in the report as "being built" appears to have been a mistake, as evidenced by two photographs of the completed machine (probably taken on the same day, as the landscape is similar in both). The reference to a 12 h.p. Buchet is probably erroneous as well, as d'Ecquevilly's second machine used an 8 h.p. engine, and a postcard depicting the first machine also mentions an 8 h.p. Buchet.

Élie-Victor Buchet was a French mechanic who established himself at Ivry, a southern suburb of Paris. His 8 h.p. powerplant was a two-cylinder engine available for 1,800 Francs, the 12 h.p. version costing 3,000 Francs. At that time Buchet was mostly known as a motorcycle manufacturer, although d'Ecquevilly was not the

only aspiring aviator to use his engines to power aeroplanes; German inventor and aviation pioneer Karl Jatho also used a Buchet engine for his aircraft.

## THE FRENCH CONNECTION

Given his ambivalent relationship with France at this time, why did d'Ecquevilly decide to build his aircraft there? Research has so far failed to reveal his motivations for returning to France — maybe Jatho's Buchet-powered experiments were the link.

Whatever the reason, d'Ecquevilly quickly established a reputation in France and by November 5, 1908, was among 250 aeronautical personalities invited by the *Aéro-Club de France* to a banquet celebrating the success of the Wright brothers, who were in the country for their historic visit that year. For this occasion he gave his name as Raymond d'Ecquevilly-Montjustin (without the Marquis title). He was to return to *Aéro-Club de France* banquets the following April, held in the presence of Orville Wright, the latter's sister Katharine Wright and French physiologist Charles Richet.

By the end of November 1908 d'Ecquevilly had rebuilt his aircraft in a much simplified form, with only six planes (five half-planes on each side of the ring structure, one single-part plane



ABOVE Of much broader span, d'Ecquevilly's second machine was photographed at Issy-les-Moulineaux in late November 1908. Note the seventh plane attached to the top of the ring structure; the machine was initially fitted with six. Later, in 1921, Flight referred to the machine as "one of those freaks so dear to certain French inventors".

above the pilot but still inside the ring structure). The pilot stood upright (no seat is apparent) in a "gondola", actually more akin to a plank, behind the engine. If the construction followed the patent, the pilot's main control was a handle through which he could orientate the rotation axis of the propeller.

Built originally with six planes, the machine had acquired a seventh plane of greater chord (perched above the ring structure) by the time it began its trials at Issy-les-Moulineaux airfield, south-west of Paris, in late November 1908. A report in *l'Aérophile* attributed this "unusual" aeroplane to the Marquis d'Ecquevilly-Montjustin (no "c" in Ecquevilly). Raymond was clearly still undecided about his own name!

The following month d'Ecquevilly described his machine in an interview with *l'Aérophile*, likening it to the 100m (330ft)-tall *Grand Roue de Paris* Ferris wheel exhibited at the *Exposition Universelle* in Paris in 1900. He claimed that "experiments have shown that in this way a very supple, very light, very robust aircraft could be built for a low price". He was less forthcoming about the questionable controllability of the machine, stating that "it would take too long and be premature to discuss the controls of the machine and its dynamic stability in both the lateral and longitudinal axes". The unspecified

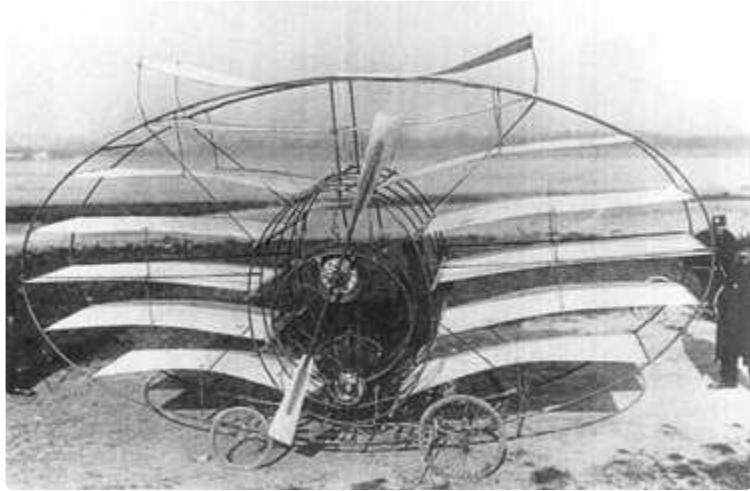
## D'ECQUEVILLY-MONTJUSTIN MULTIPLAN (LATE 1908)

THE FIGURES INCLUDED here are those supplied by Raymond d'Ecquevilly to *l'Aérophile* in January 1909. Curiously, however, German fortnightly aviation magazine *Flugsport*, in its first issue the same month, gave slightly different dimensions, which are provided here in [ ] brackets. The reason for the discrepancy in the figures remains a mystery, as d'Ecquevilly presumably supplied the figures to both!

**Powerplant** 1 x Buchet 7 h.p. piston engine driving a 2.5m (8ft 2 1/2in)-diameter propeller driven through a 1:3 reduction gear (e.g. 1,500 engine r.p.m. delivered 500 propeller r.p.m.)

### Dimensions

Span (at widest section)	5.0m [7.0m]	(16ft 4 1/4in) [23ft 0in]
Length	2.0m	(6ft 6 3/4in)
Gondola length	1.6m	(5ft 3in)
Distance between centre of gravity & centre of thrust	0.4m	(1ft 3 3/4in)
Wing area	25m <sup>2</sup> [28m <sup>2</sup> ]	(269ft <sup>2</sup> ) [301ft <sup>2</sup> ]
<b>Weight</b>	140kg	(308lb)



LEFT Another photograph of d'Ecquevilly's 1908 Multiplan, this time showing the characteristic wheeled chassis which could be rotated for ease of ground handling. Note also the 2.5m (8ft 2½in) paddle-bladed propeller, which was driven by a reduction gear.

BELOW Illustrations from d'Ecquevilly's April 1909 patent for a new aircraft with (comparatively) conventional wings, a four-wheel chassis similar to the 1908 Multiplan and an eight-cylinder engine. This was not built, and by 1910 d'Ecquevilly had apparently lost all interest in aviation.

engine was claimed to give an output of 7–8 h.p., which accords with the 8 h.p. Buchet attributed to the first machine on the postcard.

### THE MARQUIS MOVES ON

On March 15, 1909, the list of entrants for the *Grand Meeting International de Monaco* was closed. The Marquis's *Multiplan* (this word, meaning "multiple planes", appears to have been the name given to the aircraft, at least by the press), intended to be fitted with a 25 h.p. engine, was entered with the racing number 18. Unsurprisingly, however, the machine did not participate in the event.

On April 5 the same year d'Ecquevilly applied for a new patent, which reiterated his main ideas: an engine (or more precisely, power train) mounted on a suspension system which would dampen vibration and allow the axis of the propeller to be moved at will; wings which could be dismantled easily, and a wheeled carriage which could be rotated sideways. The most strikingly different feature, however, was

the use of a single wing: abandoned was the "Multiplan" concept. This new machine was never built, for reasons unknown.

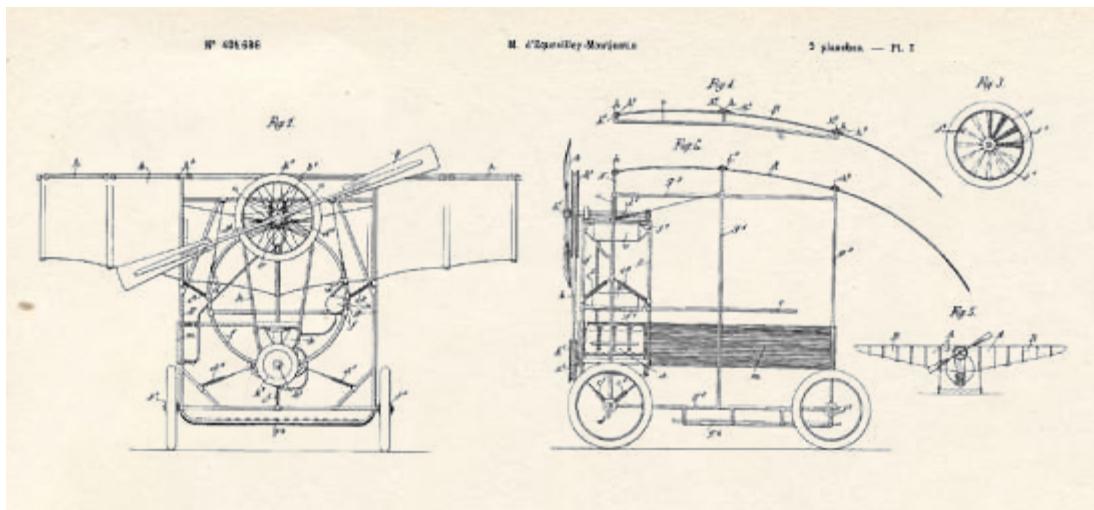
A few years later, Marcel Drouin, who had witnessed tests of the Multiplan at Issy-les-Moulineaux, recalled:

"This circular machine used no fewer than 14 [sic] aerofoils layered one above another and with the weirdest profiles. It was mounted on a four-wheeled chassis; the whole thing, being powered by a gasoline engine driving a metal propeller, produced a great frightening noise when it was put into action and tried to move with difficulty on the unequal ground."

This testimony, plus the fact that d'Ecquevilly had very little to show after some two years' experimental work on his aeronautical ideas, may explain why this controversial character chose to give up on aviation.



**ACKNOWLEDGMENTS** The author would like to thank Philippe Ricco for his invaluable help with illustrations during the preparation of this article





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# DECIDEDLY COSMOPOLITAN

## THE UNITED NATIONS' DOUGLAS C-47 SQUADRON IN THE CONGO, 1960–64

In 1960 the Belgian colony of Congo achieved independence after a very brief period of transition to a largely unprepared new local government. The resulting chaos led the United Nations to despatch a peacekeeping force to the newly minted republic, which included a C-47 unit with a truly international outlook. **LEIF HELLSTRÖM** chronicles its history

**W**HEN THE FORMER Belgian Congo erupted into chaos within days of gaining independence on June 30, 1960 — with military mutiny, Belgian intervention, secession by Katanga Province and a large-scale exodus of European administrators — the United Nations (UN) quickly assumed the task of providing “military and technical assistance” to the newly minted Republic of the Congo (renamed Democratic Republic of the Congo in August 1964) to help restore order. A UN peacekeeping force was established with astonishing speed under the name *Organisation des Nations Unies au Congo* (ONUC) and on July 15, only a day after the UN Security Council vote, the first ONUC elements arrived in the Congolese capital Leopoldville (renamed Kinshasa in 1966).

The resolution creating ONUC was vague on precisely what its duties would be — soon to become a significant problem — but it was clear that the force would have to be active in many locations throughout the vast area of the Congo. Given the poor transport infrastructure of the country — largely based on river transport — an air transport capability controlled by the UN would obviously be essential. The UN had few aircraft of its own and those were already engaged on other operations. The call therefore went out to its member states to contribute. There is no evidence that any careful analysis of the exact requirements was made at the start of the





LENNART LANG

**ABOVE** The sign outside the United Nations' C-47 Squadron office at N'Djili Airport, showing the flags of all participating nations. By the time it was put up, Yugoslavia had already left ONUC.

**MAIN PICTURE** Another day, another mission. The sun comes up over ONUC C-47 and C-119 transports during the organisation's four-year tenure in the Congo.

HANS BACKNER





**ABOVE** Experienced Swedish aviator and former flying instructor with the Imperial Ethiopian Air Force Carl-Gustaf von Rosen became the first Commanding Officer of the UN C-47 Squadron. He is seen here — in shorts and decidedly non-regulation boots — together with various other Swedish officers in the very early days of ONUC.

process, and it appears that UN Headquarters in New York was prepared to be flexible, depending on what was on offer.

### ONUC'S FIRST AIRCRAFT

The USA immediately became the primary contributor of aircraft, but not of aircrew, since there was an understanding that ONUC should not use personnel from the major Western and Eastern Bloc powers. Control of the aircraft was formally transferred to the UN under the USA's Military Aid Program (MAP). The July 30, 1960, issue of American military newspaper *Stars and Stripes* carried a note on the delivery:

"In response to a UN request, the USA will provide ten [Douglas] C-47 transport 'planes for use by the UN forces in the Congo. All aircraft are to be obtained from USAFE [USAF in Europe] bases. Air Force officials here [at USAFE HQ in Wiesbaden] say the 'planes are expected to be en route to the Congo [on] Tuesday [July 26]. Four of the C-47s are to be obtained from Seventeenth

Air Force bases in Germany and France; two from Third Air Force installations in England; two from Wiesbaden Air Base; one from Wheelus Air Base, Libya, and one other from the Azores."

It is hardly surprising that the C-47 was picked as one of the types provided; it was reliable, adaptable, easy to maintain and, above all, ubiquitous, with crews available from virtually every UN member state. On July 27 Lt-Col Sven-Erik Everstål, recently arrived from Sweden, visited N'Dolo Airport in Leopoldville to investigate rumours about the aircraft, and was immediately collared by an American officer wanting him to sign for the fleet. Everstål recalled: "We shook hands. Then I never saw him again".

Everstål was appointed acting CO of the UN Air Transport Force (UNATF), as the overall UN air unit was initially named, and within this the C-47s formed 3 Sqn. This was essentially just a paper designation, however, and was dropped entirely after six months or so, after which the common designation was simply "C-47 Squadron".

**BELOW** Curious locals line the fence at N'Dolo Airport in Leopoldville in late July 1960 to take a look at the newly arrived C-47s for ONUC. One aircraft (furthest left) has already been repainted in the organisation's overall white colour scheme, but the majority still retain the standard USAF colours they were wearing on arrival in Congo.

GORAN EDGREN



**"IT IS HARDLY SURPRISING THAT THE C-47 WAS PICKED AS ONE OF THE TYPES PROVIDED AS IT WAS RELIABLE, ADAPTABLE, EASY TO MAINTAIN AND, ABOVE ALL, UBIQUITOUS, WITH CREWS AVAILABLE FROM VIRTUALLY EVERY UN MEMBER STATE"**



STIG KJELLBERG

**ABOVE** Local labourers at N'Dolo mask the control surfaces of C-47D serial 44-76757 before it is repainted in the ONUC overall white scheme as ONU 204. Still just about visible on the aircraft's fin are the blue, yellow, green and red stripes of the C-47's previous operator, the USAF's 50th Tactical Fighter Wing, based at Hahn in West Germany.

Personnel from various countries arrived in Leopoldville over the next few weeks and were assigned to the different squadrons locally depending on their ratings; there was little or no control from UN HQ at this stage. Early aircrews included personnel from Brazil, Argentina, Yugoslavia and Ethiopia. Not all had experience of the C-47 so there was some local *ad hoc* training.

Initially there was no separate squadron commander appointed, but within a few days Count Carl-Gustaf von Rosen arrived from Sweden to check on local conditions for the Transair company, which was anticipating charter work from the UN. With vast experience, including a stint as Chief Flying Instructor with the Imperial Ethiopian Air Force, von Rosen was immediately roped in by Everstål as temporary CO of the C-47 Squadron. As a civilian, he was given a "field commission" by UNATF HQ and given some secondhand *Flygvapnet* (Swedish Air Force) major's insignia to wear. He was quickly followed by several other temporary COs from different countries over the next several months.

The first few weeks were mainly taken up with organising, training and repainting the aircraft white. The C-47s were immediately given new UN serials, 201 to 210. This was part of a numbering system for the Congo aircraft apparently created locally and had no known connection with any wider scheme. By August 1, 1960, three C-47s were listed as serviceable, with serial 202 being reported as "on mission".

A major mission followed on August 5, when the squadron's five available aircraft ferried

troops and equipment from Leopoldville to Luluabourg (now Kananga), for a planned "peaceful occupation" of Katanga's capital Elisabethville (now Lubumbashi) the following day. But Operation Simba, as it was named, was called off when it became clear that Katanga would resist. This was the only such large-scale effort by the C-47 Squadron during its existence, and any future major troop movements were instead normally undertaken by larger chartered transport aircraft or by the USAF.

### SQUADRON DUTIES

The C-47 Squadron was only one of ONUC's air assets; UNATF also included two Fairchild C-119 squadrons for heavy cargo, a Light Aircraft Squadron and a Helicopter Squadron. In addition, there was usually a fleet of chartered cargo aircraft — mostly Douglas DC-4s — which mainly operated between the major airports in the Congo. These were supported by USAF transports and aircraft from various other air forces, primarily on flights in and out of the Congo. There were few paved runways, but the Belgians had built scores of dirt airstrips all over the country, most to suit the C-47, which therefore had an advantage over other types.

At first the C-47s were mainly used as a complement to the Light Aircraft and Helicopter Squadrons for the delivery of supplies to the ONUC ground forces, which were initially scattered in small units all over the country. When needed, one or more C-47s were detached from the main squadron base to other airfields



GORAN KAUSER

**ABOVE** One of the ONUC C-47 Squadron's ten original aircraft at N'Dolo Airport, showing the plain standard finish of the aircraft and simple light blue "ONU" titles on the rear fuselage and serial number on the fin. By 1960 the UN had used C-47s for more than a decade, but the ONUC operation required a massive influx of additional aircraft.

and placed under local command. The first such detachment was to Elisabethville in August 1960, later followed by long-term detachments to Luluabourg and Albertville (now Kalemie), and periodic detachments to Bukavu and Stanleyville (now Kisangani).

From November 1, 1960, UNATF began scheduled flights between major locations in the Congo, initially comprising ten routes flown by C-47s and six by C-119s, but this varied considerably over time. These scheduled flights and the supply runs to local garrisons remained the two main tasks of the squadron over the following years but it also regularly undertook various temporary duties, including refugee flights. Use of the aircraft was supervised by ONUC's Movement Control organisation, which required an approved Movement Order for the cargo and passengers loaded on any flight. In reality, there was a certain degree of flexibility to allow for operational requirements in the bush.

There were few navigation aids in the Congo, no meteorological reports outside the capital and very little in the way of air traffic control or

service at the smaller fields, although fuel was usually available. In many ways it was a type of flying harking back to the inter-war period. It was up to each individual aircrew to find its way and handle any problems that came up en route. Night flights were rare for obvious reasons.

### THE TOWER OF BABEL

The greatest weakness of the C-47 Squadron was always the mixed origin of its personnel, coming as it did from many different countries. When possible, crews would be made up of people from the same country, or at least speaking (more or less) the same language. But this was not always possible, especially with mechanics, flight engineers and radio operators. Allowances also had to be made for nationalities which combined poorly, such as Argentinians and Brazilians.

Apart from the obvious language difficulties, with "some sort of English" being the *lingua franca*, there were major differences in operational procedures, experience and general attitude. Flight Operations in Elisabethville later made a habit of deducting a half or whole hour from the

**BELOW** The C-47 Squadron would often send detachments "up country", one of which was based at the old airfield at Albertville (now Kalemie) on the western shore of Lake Tanganyika. Here, one of the squadron's C-47s makes a dusty take-off run while one of ONUC's many Sikorsky H-19D helicopters awaits its next mission.

OLLE ANDERSSON





ABOVE In 1961 a second batch of aircraft arrived to bolster the strength of the C-47 Squadron, including two genuine DC-3s – ONU 215 (c/n 2205) and ONU 216 (c/n 1947) – without cargo doors in the rear fuselage. The former, seen here, was assembled by Fokker in the Netherlands in 1937, later serving in Sweden as SE-BWD.

flight times given to Argentinian crews since they were routinely tardy in the mornings. The two Ethiopian crews were the most competent and 1st Lt Fanta Belaya had the highest score of any C-47 pilot in a proficiency test undertaken by the Canadians. (Belaya later became Commander-in-Chief in Ethiopia and was killed in the 1989 revolution.) The Yugoslavians were also seen as "a very nice surprise", although their language skills were very poor.

N'Dolo Airport was too small to accommodate all of ONUC's air activities and the much larger N'Djili International Airport in Leopoldville soon became the focus of air operations, although the C-47s initially remained at N'Dolo. Major inspections of the C-47s had been performed since the beginning by Sabena personnel at N'Djili.

In September 1960 it was proposed to move the C-47 Squadron to Stanleyville in north-eastern Congo but this quickly became impractical owing to the political situation in the country. Instead a new Air Transport Unit (ATU) was established in late September at the large Kamina Air Base in Katanga Province. The base had initially remained under Belgian administration after independence but passed to UN control in September. This now became the maintenance centre and effectively the home base for all UNATF aircraft, except the C-119s, which remained in Leopoldville.

There were only three qualified UN C-47 mechanics available at Kamina, but luckily there were several Congolese assistant mechanics there, trained by the Belgian Air Force. ONUC did not have any major technical problems with its C-47s and a collapsed undercarriage on the ground was the only major issue during the first year.

The ATU at Kamina was a short-lived solution and in December it was decided to terminate the

operation, mainly for financial reasons. In January 1961 the maintenance centre moved to N'Djili.

In January 1961 UNATF's primarily Indian-staffed 1 Sqn was disbanded, and its five UN-owned C-119s were temporarily transferred to the C-47 Squadron before being gradually transferred to Italy for inspections. The Indian personnel were mainly transferred to fly the C-47s, including Wg Cdr Suri, who took command of the C-47 Squadron, ultimately becoming the first CO to complete a full tour of six months. Suri was later followed by another Indian and then three consecutive Brazilian COs until the unit's eventual disbandment.

### CREW ROTATION

By early 1961 many C-47 Squadron members had completed their tours and were replaced by new entries from the same countries. Contingents from Norway and Denmark had been added earlier, but the Yugoslavians had left ONUC for political reasons. There was also a new group from Greece but efforts to get additional crews from other countries, including Chile and Peru, came to nothing. As there was often a personnel shortage, the UN had to continue to accept all-comers and the squadron was to remain decidedly cosmopolitan until the end.

For the first time, statistics became available for flying hours accrued, and considerable differences were found between the different nationalities. In March 1961, for example, the Norwegian pilot who had flown the most had accrued 160 flying hours, while the highest-houred Brazilian had 50. A ceiling of 100 flying hours per month was therefore introduced for all C-47 pilots.

As early as September 1960 UNATF had recommended that the number of C-47s be increased



**LEFT** Officers of a joint ONUC—Katangese ceasefire commission pause for a group photo before boarding ONU 214, which has been adorned with a UN emblem on its rear fuselage. It is perhaps ironic that the four somewhat decrepit former Avianca machines that had arrived in March 1961 were used for VIP duties with their new operator.

**BELOW** ONUC hired several Congolese mechanics who had been trained by the Belgians before Congo gained its independence. Here a C-47's Pratt & Whitney R-1830 Twin Wasp engine is being serviced in the main hangar at N'Djili in 1961.

**"ON JUNE 29, 1961, SERIAL 203 MADE A FORCED LANDING ON OPEN GROUND NEAR TSHIKAPA . . . WHAT THE PRELIMINARY REPORT FAILED TO MENTION WAS THAT THE AIRCRAFT WAS BEING FLOWN BY A RELATIVELY INEXPERIENCED COPILOT WHILE THE INDIAN PILOT OFFICIALLY IN CHARGE WAS SITTING 170KM AWAY IN LULUABOURG . . ."**



AXEL FRIEDMANN

**BELOW** Luckily the C-47 was tough! Although former USAF C-47A ONU 203 (c/n 20010) was badly damaged during a forced landing as a result of engine failure after take-off from Tshikapa in June 1961, as seen here, nobody aboard was injured. A later summary of ONUC accidents drew a discreet veil over this incident's rather odd circumstances.

BENGT FREDHOLM





ABOVE A detachment of Indian soldiers unloads its equipment from ONU 205 (c/n 18983), a former USAF C-47A, which was put into "active storage" from February 1964. Indian Prime Minister Nehru's support for the UN in Congo was significant, the nation sending more troops than any other country involved in ONUC operations.

to 17, and during the last months of the year it became increasingly clear that a reinforcement of ONUC's air transport capacity was needed. Road and railway networks were rapidly deteriorating and the national political instability made both surface and river transport ever more difficult. The C-47 Squadron flew 1,795 hours during 1960, or about 38 hours per month per aircraft.

Accordingly, in early 1961 the UN in New York agreed to double the C-47 Squadron's complement of aircraft. Six of the additions were a very mixed bag indeed, and had been obtained by the UN as alternatives to similar numbers of Grumman Gulfstream Is or Cessna 310s that ONUC had requested for VIP and passenger runs.

Four of the new aircraft — ONU serials 211–214 — had been acquired from Colombian airline Avianca via Babb & Co in the USA, three of which were very early C-47s. The UN had clearly been cheated, as all were in very poor condition and also lacked radios. They served for less than a year before being retired. The other two aircraft — serials 215 and 216 — were actually pre-war passenger DC-3s without cargo doors. Both had been procured from Transair in Sweden and were in good condition. The final four reinforcements (ONU serials 217–220) were regular cargo C-47s received from the USAF.

## FIRST LOSSES

For a few months the squadron enjoyed a full establishment of 20 aircraft. So far the C-47s had been spared any major incidents but on June 29, 1961, serial 203 made a forced landing on open ground near Tshikapa in Kasai Province. The

starboard engine had failed immediately after take-off and the pilot had been unable to control the yaw or gain altitude. Fortunately, there were no injuries.

What the preliminary report failed to mention, however, was that the aircraft was being flown by a relatively inexperienced copilot while the Indian pilot officially in charge was sitting 170km (105 miles) away in Luluabourg. The Indian pilot was hurriedly flown to the crash site in an Otter to pretend he had been aboard the whole time and the incident was hushed up. A later summary of ONUC accidents noted that no proper accident investigation appeared to have been made; "reason remains obscure".

On September 22 the same year a Brazilian crew was approaching Kamina in ONU 216 after a flight from Luluabourg. The air traffic controller later gave a written report about what he had witnessed during the crew's attempt to land on the 2,700m (8,850ft) runway in fine weather:

"The aircraft did not appear to come into contact with the runway until at least halfway down; it bounced unevenly on the mainwheels and eventually settled down with the tail still in the air; it appeared unable to 'stick'. The aircraft still appeared to be rolling very fast with less than one third of the runway length left. I observed that the aircraft was unlikely to stop or to be able to take the 90° left turn at the end of the runway due to its speed. The rescue services were immediately called out and directed to the overshoot area.

"As the aircraft hit the touchdown lights [sic] it bounced violently [and] the tail left the ground. The [port] undercarriage then collapsed under



ABOVE ONU 218 drones across the Congolese skies in December 1962, photographed by a Flygvapnet Saab S 29C Tunnan reconnaissance jet — for more on the latter in Congo see the author's *To Africa In A Barrel* in TAH13.

LEFT When necessary, the C-47 could transport reasonably large items, such as this Wright R-1300 engine, used by ONUC's fleet of H-19D helicopters.

BELOW After suffering shrapnel damage during Katangese air attacks at Elisabethville in September 1961, the hulk of ONU 209 was used for accommodation by ONUC aircrews. One officer used the stripped cockpit as his personal cabin.





SVEN KEMPE

**ABOVE** Kindu in eastern central Congo was one of the regular stops for the C-47 Squadron on its scheduled flights in 1962. Seen here at Kindu, ONU 218 (c/n 19781) was one of the last batch of C-47s received from the USAF in 1961. Kindu later became the main air base for the UN's MONUC stabilisation operation from the year 2000.

the heavy strain and the aircraft swerved round to the left, facing 180° from the approach direction. The rescue crews arrived almost immediately the aircraft had come to rest in a position about 300ft [90m] from the end of the runway."

The aircrew stated that the aircraft had "unexplainably" floated above the runway at 100kt for 1,000m (3,300ft), and when they had attempted to "go around", the engines did not respond. But the crew's individual statements indicate confusion over who was actually flying the aircraft at the time. Nobody aboard suffered any injuries and the aircraft was stripped for parts and dumped near one of the hangars.

## COMBAT CASUALTIES

When the situation between ONUC and Katanga deteriorated into open fighting in September 1961, several C-47s were sabotaged by having sugar and sand poured into their fuel tanks, which were drained and cleaned within a few days. At least four C-47s also received bullet holes during the fighting and were withdrawn from the area after temporary repairs.

During an air attack on Elisabethville Airport by a Katangese Fouga Magister on September 15, C-47 ONU 209 was completely peppered with shrapnel and had its tyres punctured. Two days

later its fuselage was warped beyond repair after two small bombs exploded 20m (70ft) away. The C-47 was written off, dragged to one side and relegated to crew quarters. The other damaged C-47s were repaired relatively quickly but two — ONU 205 with 50 holes and ONU 219 with 87 — took until November to return to operations.

In the renewed fighting that broke out in December, ONU 211, with an Argentinian crew, was hit by groundfire when coming in to land at Manono in Tanganyika Province. The C-47 was hit in the port engine and both wing tanks and had to be taken out of service for repairs.

The situation during the autumn of 1961 took its toll on the C-47 Squadron. From late September to late October, a Royal Danish Air Force C-47 (serial K-687) was on loan to the unit, but this was only a temporary relief. Owing to Katangese air superiority during the September fighting, ONUC received its own fighter aircraft from October 1961, and at the same time UNATF was redesignated as the UN Air Division. The existing squadrons were not otherwise affected.

By October 31, 17 C-47s remained in the squadron, of which only ten were serviceable. No fewer than eight were on detachment in four locations and the squadron had all but ceased its scheduled flights. From November 5 two



**ABOVE** Doing it the old-fashioned way — if one of the C-47's starter motors failed, the crew got the engine started by winding a rope around the propeller hub and pulling it with a Jeep, as seen in this photograph of ONU 208 (c/n 26122) at a typical remote strip.

STEN JOHNSON / SFF ARCHIVE



**LEFT** On September 20, 1962, former USAF C-47D ONU 202 (c/n 32532) was shot down by groundfire while on a reconnaissance mission from Kamina. The crew managed to get the aircraft down, but two passengers were killed and the aircraft burned out.

FORSVARSTABEN

**BETWEEN** The C-47 Squadron's duties often took the unit's aircraft to the many dirt airfields in the Congo. Here ONU 208 departs a typically primitive 1,000m (3,300ft) strip "up country".

STEN JOHNSON / SFF ARCHIVE





ABOVE Two ONUC C-47s were temporarily leased to the Congolese Air Force in mid-1964 and given temporary registrations; 9T-PDX, seen here, was the former ONU 204. The men facing the camera are exiled Cubans hired by the CIA for its Congo air operations, the exiles flying missions against rebels supported by communist countries.

C-47s were also used to search for Katangese air activity, such work becoming increasingly common over the next few months as ONUC lacked proper reconnaissance aircraft. A camera pod was requested for mounting under a C-47 but none was ever received. When on photographic missions, pictures therefore had to be taken from the cargo door using normal cameras, with predictably poor results.

The year ended with only eight C-47s serviceable, the unit having flown 9,181 hours during 1961. The fleet was becoming tired and several aircraft needed extensive repairs owing to corrosion. ONUC therefore decided that the squadron be reduced to ten active aircraft, with three in reserve. The four ex-Avianca machines, which were in the worst condition, were to be retired. The change was implemented during March–April 1962. Of the ten remaining C-47s, four were now on detachment to Albertville, Luluabourg, Stanleyville and Bukavu.

## THE SHOOTING DOWN OF ONU 202

By this time the political and military situation in the Congo had become static, and little happened of note during the first eight months of 1962. Meanwhile, the financial situation for ONUC went from bad to worse and various austerity measures were introduced. The C-119 Squadron was disbanded in June 1962 and the following month an order was issued that air transport had to be reduced to a minimum. At this time, the

C-47 Squadron had only six serviceable aircraft, detached to six different airfields.

On September 20, 1962, C-47 ONU 202 was despatched from Kamina to look for Katangese troops in northern Katanga. The crew of four was all-Swedish and in addition six observers were carried, also all Swedes. The cargo doors had been removed and a rope stretched across the opening for safety.

At 1125hr ONU 202 was about 160km (100 miles) north-east of Kamina at fairly low altitude. The observers never heard or saw anyone firing from the ground (although those in the cockpit did hear firing) but suddenly there was a series of popping sounds in the aircraft skin. Swedish aircraft mechanic Per-Olov Sølvstad was killed instantly, his colleague Raoul Colmgren mortally injured and the radio operator Björn Bäck hit in the wrist. The C-47's captain, Anders Lundquist, later told *Aftonbladet* newspaper:

“Suddenly we heard a loud bang in the [port] engine. We reacted in exactly the same way: ‘Now the engine has seized’. But a second later a whole series of bullets rattled through the fuselage. We were being fired upon . . . Another couple of salvos hit the aircraft. The [port] engine had stopped almost completely; at any rate it provided no power. Perhaps 1½min had passed since the shooting started. Left rudder did not work [and] the elevator was damaged. I had to glide down for a landing. There was no need to extend the undercarriage; it would just be in the way.”



**ABOVE** The end of the C-47 Squadron came in February 1964, when the remaining aircraft were gathered at N'Djili. Representatives of each country contingent parade in front of ONU 215, which was retained by ONUC for "special missions". The antenna on the nose is for the SARAH receiver, used to locate aircrews' emergency transmitters.

It was later estimated that the C-47 had been struck by some 150 bullets. The resulting forced landing was on open ground and not particularly violent, although a fire immediately broke out.

Three of the crew hid in the bush and were rescued by a UN helicopter the following day. The others were captured by villagers and taken to a nearby village where there were some *Armée Nationale Congolaise* (ANC — Congolese Army) soldiers. They were later taken to a nearby town where a UN helicopter picked them up.

Although all the signs pointed to the C-47 being shot down by the ANC, the official UN investigation made reference to both ANC and Katangese units being in the area, without apportioning any blame. Within ONUC this was generally considered a political whitewash.

## DOWNSIZING AND DISBANDMENT

The C-47 Squadron inventory remained at 12 aircraft after the loss of ONU 202. The year ended with 7,392 hours flown by the unit — a lower total than in 1961 but an increase per aircraft.

Once the Katangan bid for secession had ended in early 1963, there were increasing calls for a significant reduction in ONUC's strength. This resulted in the C-47 Squadron being reduced by a further third in June 1963, and at the same time ONUC withdrew all of its chartered aircraft. At the peak of operations in the Congo, ONUC had fielded 56 transport aircraft (not counting USAF

and other member-state-operated flights); now all that remained were eight C-47s. The various detachments were disbanded and all C-47s now operated from N'Djili, mainly on scheduled flights.

Even this reduced strength did not remain for long, and in the new year of 1964 the UN decided to disband the C-47 Squadron entirely, for economic reasons. The squadron's flight operations ceased on February 8, 1964, but two aircraft with Brazilian crews were maintained in readiness for "special missions", as directed by ONUC HQ, and approximately 100 hours were flown during March and April. ONUC itself was disbanded on June 30, 1964, although a small civilian cadre remained for another six months. At least one C-47 mission was flown as late as August 1964.

In May and June that year two C-47s were rented to the *Force Aérienne Congolaise* (FAC — Congolese Air Force) to support operations against a new rebellion that had broken out during the spring. On paper, the FAC operated T-6s and T-28s used as ground-attack aircraft, but in reality these and the C-47s were all flown by Cuban exiles hired by the USA's Central Intelligence Agency (CIA).

The bulk of the ONUC C-47 fleet was left at N'Djili airport, and the final fate of some of the aircraft is unclear. One or two saw subsequent civilian use but most were apparently sold to Air Congo for spare parts, with their hulks remaining lined up at N'Djili for many years.



# DOUGLAS C-47/DC-3s IN ONUC SERVICE, 1960–64



ONUC Serial	Variant*	C/n	Previous identity/ last operator	Served from	Served to	Remarks
201	C-47A	9957	42-24095 (USAF)	7.60	12.7.63	Sustained damage requiring new wing, although the wing apparently was never changed
202	C-47D	32532/15784	44-76200 (USAF)	7.60	20.9.62	Search and rescue and homing (SARAH) gear installed. Shot down by groundfire near Kumenza
203	C-47A	20010	43-15544 (USAF)	7.60	29.6.61	Crashed on take-off at Tshikapa
204	C-47D	33089/16341	44-76757 (USAF)	4.8.60	2.64	In “active storage” from 2.64. Loaned to <i>Force Aérienne Congolaise</i> (FAC) during May–June 1964. To 6V-AAO, 1966
205	C-47A	18983	42-100520 (USAF)	4.8.60	2.64	In “active storage” from 2.64
206	C-47B	20068	43-15602 (USAF)	4.8.60	circa 6.63	Withdrawn from use (WFU); to spares aircraft?
207	C-47D	25855/14410	43-48594 (USAF)	8.8.60	6.63	WFU; to spares aircraft
208	C-47D	26122/14677	43-48861 (USAF)	11.8.60	2.64	In “active storage” from 2.64. To TT-LAC
209	C-47D	25927/14482	43-48666 (USAF)	12.8.60	17.9.61	Struck off charge (SOC) after damage received during Fouga attacks at Elisabethville. Used as living quarters
210	C-47D	26974/15529	43-49713 (USAF)	1.9.60	2.64	In “active storage” from 2.64. To 9Q-CIG, 1967
211	C-47	4757	42-21943, HK-312** (Avianca)	2.3.61	1.4.62	Stored from 3.62. Sold 10.62? To 6V-AAK, 1963–64
212	C-47A	19654	43-15188, HK-325 (Avianca)	2.3.61	1.4.62	Stored from 3.62. Sold to European Research Co, Brazzaville, circa 1.64
213	C-47	9139	42-32913, HK-117 (Avianca)	2.3.61	1.4.62	Stored from 3.62. Sold to European Research Co, circa 1.64
214	C-47	4351	41-7852, HK-324 (Avianca)	9.3.61	1.4.62	Stored from 3.62. Sold 10.62? To Air Senegal as 6V-AAA
215	DC-3	2205	SE-BWD (TSA)	2.61	1964	SARAH gear installed. “Special flights only” from 2.64. To 9Q-C..?
216	DC-3	1947	SE-BWE (TSA)	2.61	22.9.61	Written off after groundloop during landing at Kamina
217	C-47A	13700	44-93753 (USAF)	3.61	1964	In “active storage” at N'Djili from 2.64. Loaned to FAC May–Jun 64. To Air Congo, 1965
218	C-47A	19781	43-15315 (USAF)	3.61	circa 6.63	WFU; to spares aircraft?
219	C-47B	20505	43-16039 (USAF)	3.61	1964	“Special flights only” from 2.64. To 6V-AAP, 1966
220	C-47A	9780	42-23918 (USAF)	3.61	2.64	In “active storage” at N'Djili from 2.64. To 9Q-CUD, 1966
<b>K-687</b>	C-47A	19200	42-100737 (RDAF)	26.9.61	30.10.61	Temporary assignment only

\* Variant for ex-USAF aircraft as shown in USAF Record Cards at transfer

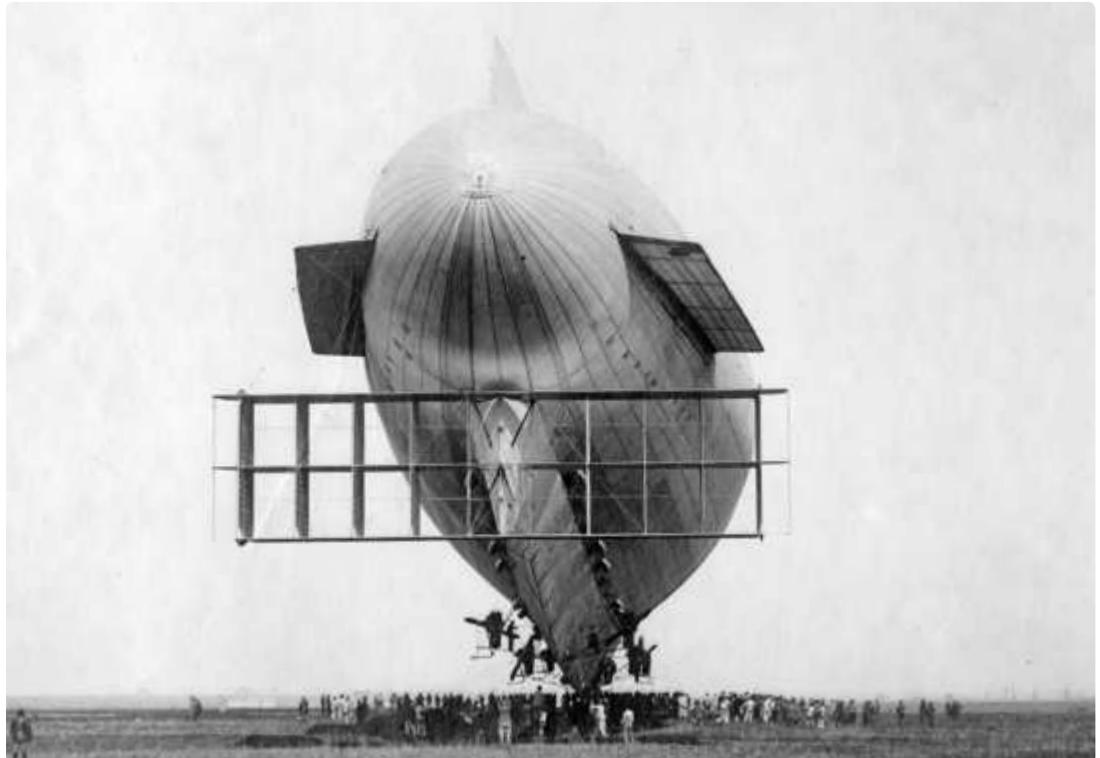
\*\* For former civilian aircraft, only latest registration before transfer is shown



# The short TRAGIC life of the AIRSHIP ROMA

After the First World War Italy took a particular interest in the development of the airship for commercial purposes, the nation's designers focusing on the semi-rigid dirigible as the future of civilian air transport. **LUIGINO CALIARO** describes the all-too-brief history of the ill-fated *Roma*, which came to grief in the USA within months of its arrival at its new home





**I**TALY, ALONG WITH Germany, was the nation which made the greatest use of the dirigible during the course of the Great War, even if the rapid development of the aeroplane had relegated the use of these large airships almost exclusively to nocturnal operations. After the war, especially in Italy, despite the technical limitations that emerged during the conflict, numerous proponents of the validity of the airship remained, especially in the field of civilian applications, where its great capacities for transport and endurance offered possibilities which were unthinkable for the aeroplanes of the time.

#### ITALY AND THE DIRIGIBLE

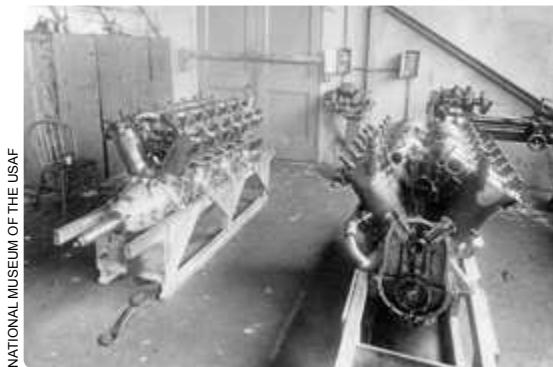
Italian designers in particular focused their attention on "lighter than air" concepts, with dirigibles featuring a semi-rigid structure, characterised by a triangular-section central assembly to which were fixed the cabin and engines, and on which was mounted the envelope, composed of two distinct parts. The first was occupied by the various over-pressure hydrogen gas cells, equipped with dedicated venting valves. The stability of the shape of the envelope and the structure of the airship was delivered by means of the second

part, which comprised the body of the envelope, formed by sacs of air called "ballonets", which by expanding or contracting allowed compensation for any changes in the volume of the lift-providing gas. The entire assembly was strengthened by a large rigid parabolic structure located at the prow of the dirigible.

This formula allowed the construction of small and medium-sized airships (10,000–40,000m<sup>3</sup>) as well as a reduction in the cost and construction times in comparison with the rigid-structure dirigibles developed by the Germans. The Italian idea found its apex in the dirigibles designed by Umberto Nobile and used for a series of celebrated polar expeditions.

In the post-Great War period the idea of using large airships for civilian transport attracted quite a following among Italian designers, to the point that by 1919 the principal designers in the sector — Nobile, Celestino Usuelli and Arturo Crocco, together with *Ingenuere* Prassone — began the study of a new semi-rigid large-volume dirigible capable of undertaking transcontinental flights. The concept would, however, only become a reality thanks to the intervention of *Generale* Maurizio Mario Moris, who arranged for the construction of the new airship at the *Stabilimento Costruzioni Aeronautiche* of the Regio

**OPPOSITE PAGE & ABOVE** Airship T.34, later named Roma, is prepared for its first flight at Ciampino airfield, south-east of Rome, on March 19, 1920. The airfield was completed in 1916 as a cantiere dirigibili (airship base), owing to its calm wind conditions and proximity to major strategic road and rail networks. P. MONTI ARCHIVE VIA AUTHOR



**TOP** The majestic sight of the T.34 during one of its first test flights. Note the distinctive triplane tail. **ABOVE LEFT** The T.34 was delivered with 450 h.p. Ansaldo San Giorgio engines, seen here after their removal from Roma in the USA. **ABOVE RIGHT** On September 20, 1920, King Vittorio Emanuele III flew aboard Roma to Naples and Palermo.

Esercito (Royal Army). The designation of the new airship was T.34 — T for transatlantic and 34 indicating the total volume of the airship, 34,000m<sup>3</sup> — to be given the name *Roma*.

As designed, the dirigible was the largest semi-rigid airship ever constructed, boasting a total length of 128m (419ft 11½in) and a diameter of 22m (72ft 2in). The profile of the airship displayed a few similarities with that of the great German Zeppelin airships (the construction philosophy of which was, however, very different, comprising a rigid metal structure), but had a much less tapered form than the German machines, with a cruciform tail and a large triplane tailplane. The triangular central beam ran from bow to stern, attached to which were the gondolas for the six 450 h.p. Ansaldo San Giorgio engines, driving large wooden pusher propellers, accessible in flight if maintenance was required. The command cabin could potentially be configured for 25 passengers.

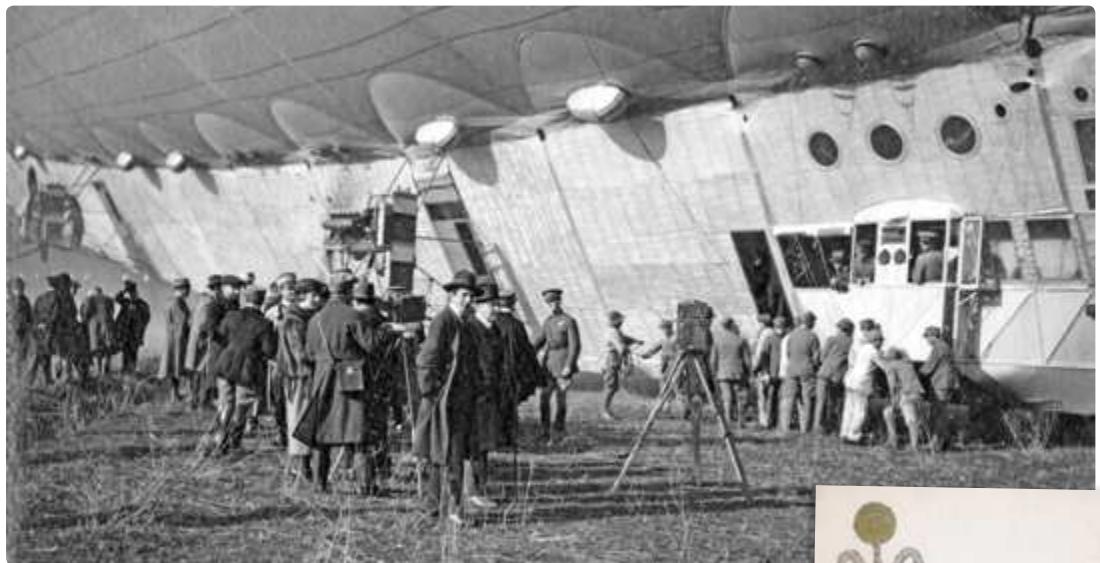
By means of a series of internal walkways and stairs, the crew could access the internal parts of

the airship in order to respond to maintenance needs. The total weight of the airship was just under 20 tonnes, but its most remarkable asset was its speed, some 110km/h (68 m.p.h.).

### FIRST FLIGHTS

*Roma* made its first flight on March 19, 1920, and during flight trials did not encounter any serious technical problems. Particularly noteworthy was a test flight undertaken on September 20 that year with King Vittorio Emanuele III as guest of honour on a flight between Rome, Naples and Palermo. Despite the new airship's innovative features and performance, the Italian civilian transport market was not yet receptive to such a machine and, after lengthy negotiations which had started in mid-1920, *Roma*'s sale to the government of the USA was formalised in the early months of 1921 for \$184,000; considerably less than the exorbitant starting price of \$475,000.

On March 15, 1921, during the airship's acceptance flight by the American crew (Maj John G. Thornell, Capt Dale Mabry and Lt W.J.



**TOP & ABOVE LEFT** On March 15, 1921, *Roma* was handed over to its American crew, which undertook a long sightseeing tour from Rome with numerous dignitaries aboard. The flight took the airship south to Naples and over the island of Capri, as seen here. **ABOVE RIGHT** The luxury menu presented to the guests aboard the flight.

Reed), distinguished guests aboard included the USA's Ambassador to Italy, Robert Underwood Johnson, and Prince Vigo of Denmark. The flight was particularly long, *Roma* overflying Naples and the island of Capri, offering the guests breathtaking views of Vesuvius and a gourmet lunch with champagne.

For *Roma*'s transfer to the USA, the American officers initially considered making a direct transatlantic crossing, later opting, probably wisely, to dismantle the airship and transport it by sea to the Port of New York.

Early in August 1921, a month after *Roma* left Italy, assembly of the dirigible commenced at Langley, Virginia, where a large hangar had been built, along with laboratories established for generating hydrogen. The final base for the airship was intended to be Brooks Field, near San Antonio, Texas, home to a school training aerial observers for the US Army.

The reassembly of *Roma* was completed at Langley on November 5, 1921, and on the morning of the 15th more than 1,000 spectators

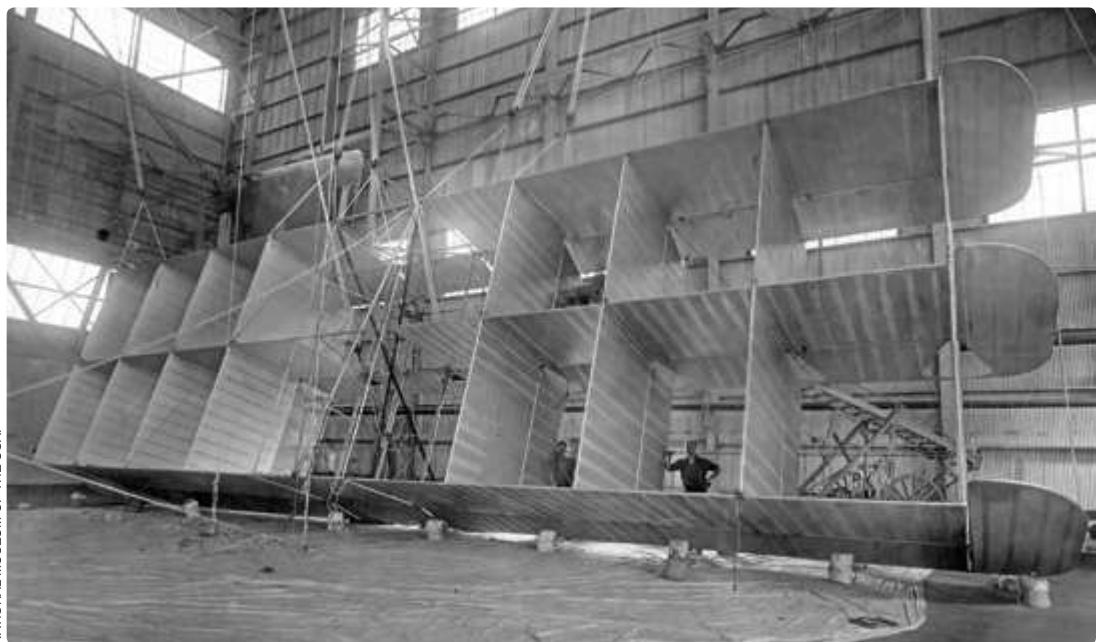
arrived at the field to see its rollout. At the controls was Thornell; the silver dirigible, on the prow of which was painted the word "ROMA" and a white five-pointed star, majestically emerged from the hangar. At 1030hr, after almost an hour of pre-flight preparations, the airship began to lift slowly into the air, although problems quickly developed with the Ansaldo engines, which failed to deliver their full power. Despite this problem, the commander continued the flight with no further issues until 1130hr, when a leakage of hydrogen was detected. The technicians on board managed to repair the leak, and at 1300hr the dirigible commenced the docking operation, concluded successfully after half an hour. Another rather more successful flight was conducted on November 23.

### THE OFFICIAL CHRISTENING

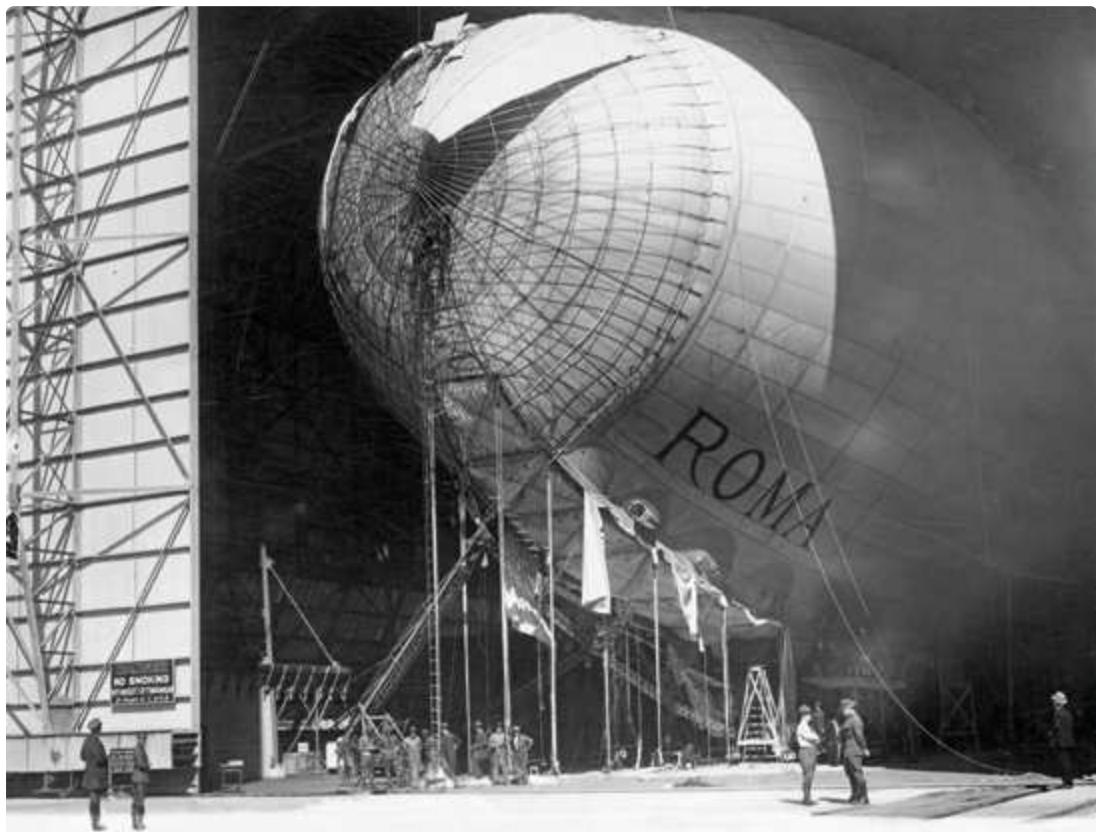
In the meantime, the ceremony for the official christening of the airship had been organised for December 9 at Bolling Field in Washington



**ABOVE** The main cabin of Roma, able to accommodate around 25 passengers, during its reassembly in the USA. The airship had been conceived as a transatlantic passenger aircraft from the outset, and designers in Italy also studied a prospective larger airship — project T.120 — which would be capable of accommodating 100 passengers.



**ABOVE** Three engineers in the airship shed at Langley in the late summer of 1921 lend scale to the sheer size of Roma's multiplane boxkite tail before its installation. The tail unit comprised three superimposed horizontal planes with elevators hinged to each, plus eight vertical surfaces and rudders, mounted on the rear of the keel.



ABOVE Roma pokes its nose out of the airship hangar at Langley before its first flight in the USA on November 15, 1921. The largest semi-rigid airship in the world, Roma maintained its aerodynamic shape using internal gas pressure, but had a rigid keel which distributed loads and provided structural integrity during manoeuvring.

DC. That morning, however, the unreliable Ansaldo engines created further problems, delaying the departure of the airship from Langley, forcing the ceremony to be postponed until December 21. Again the airship suffered technical problems, arriving just before noon at Bolling Field where, hindered by a strong gusting wind, it presented itself to the public flying in an erratic manner and with a portion of the envelope detached. Thanks to the efforts of the aircrew and ground support personnel, however, it was possible to anchor the airship, but the eagerly anticipated demonstration flight in the afternoon, which was to carry various civil and military dignitaries, had to be cancelled.

In the course of the ceremony the Italian Ambassador, Rolando Ricci, thanked the American government and military leaders for giving their permission to retain the original name of the airship, stating: "I thank all the authorities for the courtesy they have demonstrated, which is a courtesy towards all of Italy". For his part, American Secretary of War John W. Weeks offered his compliments and thanks to the Italian technicians and to the American crew, which, despite the unfavourable conditions, had managed to complete the flight

from Langley. Just before the classic launch of the champagne bottle, Italian Chief of Staff Gen Giuseppe Vaccari, together with Thornell, unveiled a new American flag on *Roma*'s stern.

On December 31 Thornell passed command of *Roma* to Capt Mabry, who was given the task of supervising the replacement of the airship's Ansaldo engines with more powerful and more reliable Liberty powerplants. Concurrently, repair work was undertaken on the envelope and internal compartments, although Mabry, in a letter dated February 1, 1922, emphasised to the commandant of the Airship School the necessity of replacing the external envelope and ballonets.

On August 23, 1921, US Navy airship ZR-2 (former British rigid dirigible R38) had crashed in the UK, caused by structural failure and subsequent fire, with the loss of most of its crew. As a result of the tragedy, a request was advanced to replace the use of highly flammable hydrogen with helium, an inert gas that does not burn, but which was expensive. Unfortunately, the request was denied for budgetary reasons. It was a decision that was to have a profound effect on *Roma* and its crew.

After a few weeks of work to install the new engines, it was planned that *Roma* would resume



**ABOVE** US Army airship *Roma* over Norfolk, Virginia, during its second test flight on November 23, 1921. The original Ansaldo engines, still fitted at this time, were arranged at various angles of incidence – the forward pair at 12°, second pair at 10° and the aftmost pair parallel to the line of flight – to prevent slipstream interference.

flying in late February 1922. On the 21st of the month, following a morning spent awaiting an improvement in the weather, the airship was pulled out of its hangar just after 1200hr and 45 people including flight crew, technicians and VIPs, took their places in its passenger gondola. *Roma* took off in the early afternoon, and, from the moment of the release of the docking cables, Mabry had to work hard to control the airship. The dirigible immediately started to gain height too quickly, assuming a pronounced nose-up attitude, and only after some decisive intervention on the bleed-air valves was the correct flying attitude resumed.

After this initial problem, the flight proceeded well at first, with *Roma* achieving a speed of 120km/h (75 m.p.h.), never obtained with the Ansaldo engines. It was noted that the American engines functioned perfectly, generating less vibration through the airframe than their Italian predecessors. The calm nature of the flight was disturbed, however, by the detection of a loss of gas in the forward part of the airship. However, because it seemed to have stabilised, Mabry decided to continue the sortie.

### THE FINAL FATAL MOMENTS

Just before 1400hr an abnormal vibration was detected in the command cabin, a loss of gas was detected in the No 1 gas compartment and the alarm was raised. At 1410hr, while the airship was flying over the Army Quartermaster Depot at Elizabeth River, Lt Byram G. Burt, who was at the elevator controls, noted that the latter were not functioning. Having lost control of the airship, Mabry gave the order to shut down the engines immediately and make an emergency

landing, aiming the airship towards the fairways of the Norfolk Country Club beyond the Lafayette river. Despite all the efforts of the crew, *Roma* was now doomed. By this point completely out of control, *Roma* pitched nose-down 45° and crashed to earth inside the military depot, cutting through numerous overhead high-voltage power lines within the compound, resulting in a fierce hydrogen fire. Incredibly, 11 of the 45 men aboard survived.

The US Army Air Service immediately ordered the establishment of an inquiry to determine the reasons for the loss of *Roma*. One of the first discoveries was that the majority of the victims had been killed by the ensuing hydrogen fire, confirmed through the questioning of witnesses and some of the survivors, who expressed their conviction that many of the crew members could have been saved had helium been used instead of hydrogen. It was determined that the crash had been caused by a complete loss of control, and it was suggested that some of the control lines had severed after the forward rigid structure of the airship had suddenly collapsed owing to a loss of gas in the No 1 compartment. Although it was not possible to determine with certainty the reason for the loss of gas, it was decided that the principal cause of the incident was linked to the degradation of *Roma*'s covering. Indeed, it had been noted at take-off that the external covering was in poor condition, and some witnesses confirmed that pieces of the envelope fell to the ground as *Roma* lifted off.

Bitter arguments broke out at senior military level over the failure to assign funding for the replacement of hydrogen with helium. In Italy the tragedy naturally had great resonance, and



LEFT The American crew that took delivery of Roma in Italy. From left, standing: Sgts J.M. Biedenback, V.C. Hoffman, M.J. Beale, H.A. Chapman and R.C. McNally. Sitting, from left: Lt W.J. Reed, Maj J.G. Thorrell and Capt Dale Mabry. BELOW Rescue workers look on as a crane removes the twisted metal of the destroyed Roma at the US Army Quartermaster's Depot in Norfolk after its crash on February 21, 1922.

NATIONAL MUSEUM OF THE USAF x 2

engendered numerous discussions and inquests, resulting in an absolution of the airship's design, given that *Roma* was flying too low, leaving little room for manoeuvre for the crew in case of an emergency. Umberto Nobile declared that the accident was "caused by a series of unfortunate circumstances which resulted in the dirigible impacting an area with numerous power lines".

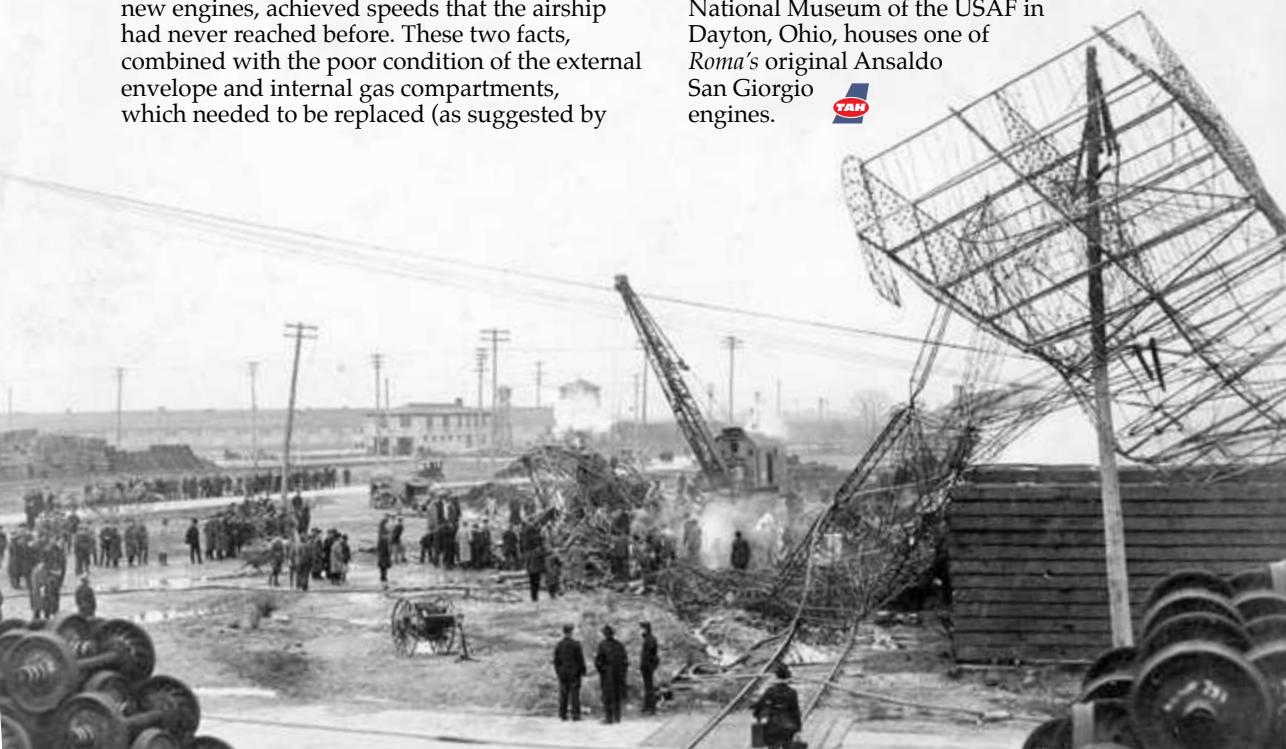
### THE AFTERMATH

With hindsight we can see that the tragic accident, like most, was the result of a series of interlinked events, some partly down to misfortune and some caused by human error. *Roma*'s final flight was conducted at very low altitude, around 150m (500ft) and, thanks to its new engines, achieved speeds that the airship had never reached before. These two facts, combined with the poor condition of the external envelope and internal gas compartments, which needed to be replaced (as suggested by

Mabry), could have led to the loss of hydrogen from the forward compartment, engendering structural stress that was beyond the limit for *Roma*'s keel. The consequent collapse of the frontal rigid structure resulted in the severing of the control lines, also constructed from rigid material, leaving the elevator positioned at an angle of descent of around 45°. The inquiry also established that the crew, at the beginning of the flight, had not adequately compensated for the difference in weight of the American engines and had not uploaded sufficient ballast; actions which may have contributed to the initial problems encountered on take-off.

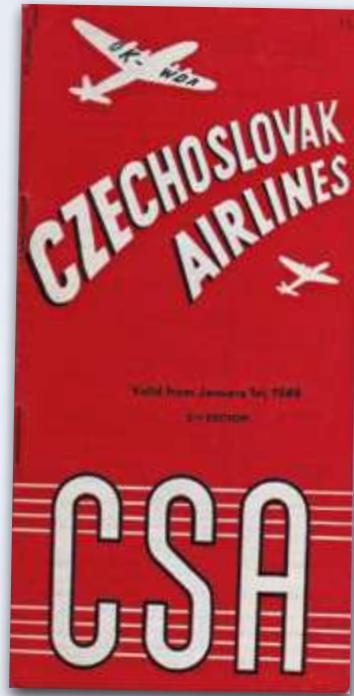
The only point which remained unresolved was the reason why the forward engines remained functioning at the time of the crash. The only plausible hypothesis was that in the sequence of a fast-moving chain of events the order to shut down the engines did not reach the relevant engineers. The incident stoked the fires of debate in the USA on the validity of dirigibles, but also resulted in the decision to cease the use of hydrogen in favour of the adoption of helium.

As a memorial to the tragedy, a commemorative plaque was mounted at the place where *Roma* fell to earth, in memory of the 34 occupants who lost their lives. In addition, the National Museum of the USAF in Dayton, Ohio, houses one of *Roma*'s original Ansaldo San Giorgio engines.

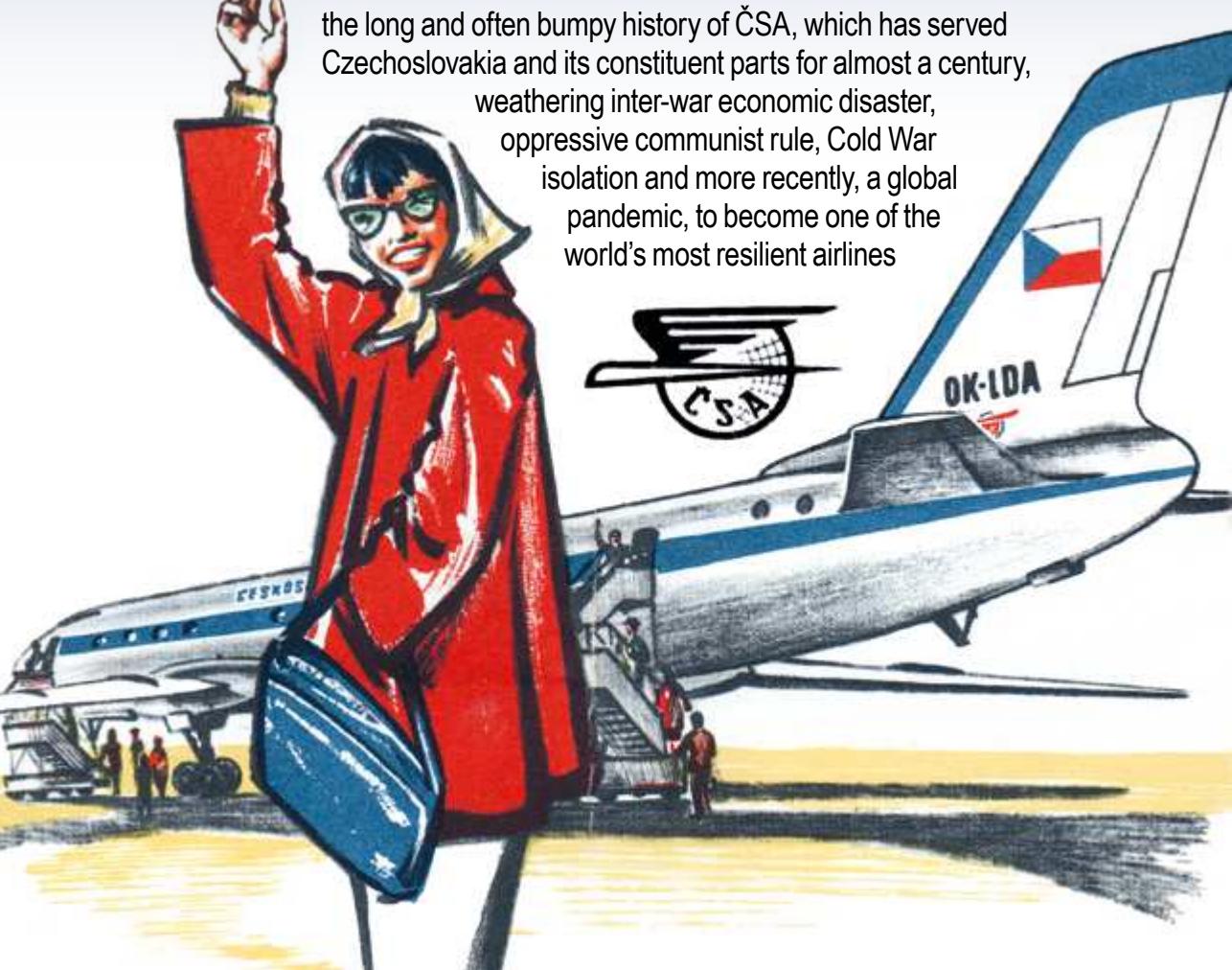


# Czechoslovakia's “CAREFULLY SERVING AIRLINE”

**THE LONG, TURBULENT  
HISTORY OF ČESKOSLOVENSKÉ  
STÁTNÍ AEROLÍNIE, 1923-2021**



Renowned airline historian **MAURICE WICKSTEAD** traces the long and often bumpy history of ČSA, which has served Czechoslovakia and its constituent parts for almost a century, weathering inter-war economic disaster, oppressive communist rule, Cold War isolation and more recently, a global pandemic, to become one of the world's most resilient airlines





**U**NTIL FAIRLY RECENTLY, ČSA Czech Airlines was one of the few remaining state-owned airlines in Europe. Now completely privatised, it returned to profit in the mid-2010s after decades of political and economic uncertainty, only to fall victim, as has every airline in the world, to the economic fallout of the Covid pandemic. That it has survived many turbulent times throughout its history is testament to its dedicated personnel and the resilience of the people of Czechoslovakia.

### Early days

Among the new independent states created at the Paris Peace Conference in the wake of the First World War, Czechoslovakia was one of the first to establish its own airline. This initiative was particularly significant for the economic development of a country fast becoming one of Europe's leading industrialised nations.

Five years after the nation's birth, Československé státní aerolinie (ČSA) came into being on October 6, 1923, and made its first flight three weeks later on October 29. Linking the republic's two capitals, Prague and Bratislava, an Aero A.14 (a modified version of the German Hansa-Brandenburg C.1) registered L-BARC, flown by military pilot Karel Brabenec (later ČSA's chief pilot), covered the 321km (200 miles) in 3hr, carrying a journalist and a token 775g (1.7lb) of mail.

Previously the only air connection to Prague was from Paris with France's *Cie Franco-Roumaine de Navigation Aérienne* (CFRNA), in which the Czechoslovakian government had a

shareholding. There had been an earlier private attempt to form an airline, Československá letecká akciová společnost (ČLAS) in May 1922, primarily by Czechoslovakian aircraft manufacturers, but it never really got off the ground owing to financial problems. Following a series of trial flights conducted by the Czechoslovakian Army's Aviation Detachment starting in March 1923, the state decided to take up the reins and form its own airline, ultimately overseen by the Ministry of Public Works.

Later in 1923 ČSA acquired five three-passenger Aero Letňany A.10 cabin biplanes from the failed ČLAS, but their Maybach engines proved unreliable and they completed only 25 flights for the airline. In the few weeks up to the end of 1923 a total of 29 passengers and 800kg (1,800lb) of mail and baggage was carried.

After the winter break, on May 5, 1924, the original Prague—Bratislava line was extended to Košice, the largest city in the east of the country, but ČSA was struggling with its rudimentary aircraft. To solve this problem the French Farman F.60 Goliath and British de Havilland D.H.50 were put into production under licence in 1925. A single Junkers F 13 was also obtained, but proved unsuitable, while seven locally-built Letov S.19 converted bombers came into operation in 1927.

Another government-backed enterprise was a line between Prague and Mariánské Lázně, 170km (105 miles) east of Prague, established in June 1925 by the indigenous Aero aircraft works. It was taken over by ČSA in July 1927, but not before it had carried 961 passengers and

**TOP** The Aero Letňany A.10 single-engined biplane was the first commercial aircraft to be designed and built in Czechoslovakia and made its maiden flight on January 3, 1922. Five examples were completed, all serving with ČSA in the airline's early years. **OPPOSITE PAGE, TOP** A ČSA timetable dated January 1, 1949. **OPPOSITE PAGE, BOTTOM** Into the jet age with the Tu-104A — a detail from a mid-1950s ČSA timetable. TIMETABLE VIA CAPT DACRE WATSON

*In 1928 Czechoslovakia's civil registration prefix-letters changed from L-B to OK-, the former L-BAAD, an Aero A.23, becoming OK-AAD, as seen here. CSA operated seven A.23s, each powered by a single 420 h.p. nine-cylinder Walter Jupiter IV radial engine and incorporating a six-passenger cabin. The type remained in the CSA inventory until the mid-1930s.*

AUTHOR'S COLLECTION



AUTHOR'S COLLECTION

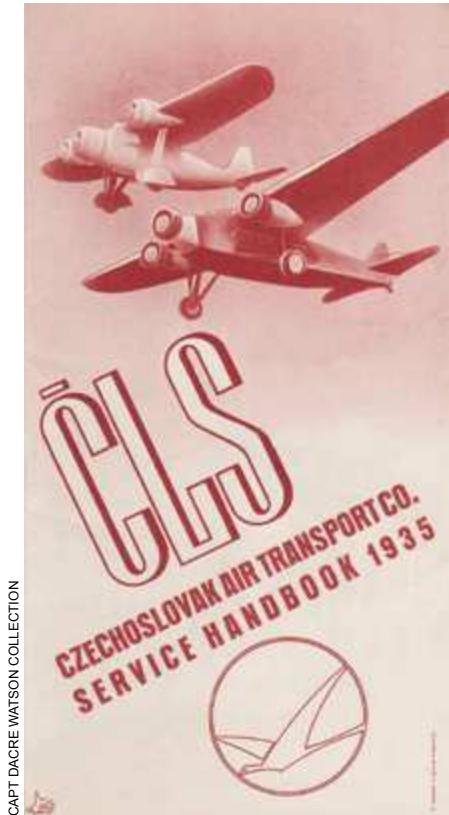


**ABOVE** The three-engined Letov Š.32 made its first flight in 1931, all five examples built – OK-ADA to OK-ADE – operating with ČSA on the airline's Prague–Mariánské Lázně–Karlovy Vary route. Although perhaps not the most elegant of airliners, the rugged Š.32 was nevertheless a sturdy workhorse capable of operating at night.

VIA MIROSLAV JINDRA



**ABOVE** During 1935–36 ČLS acquired two Fokker F.XVIII trimotors – OK-AIQ and OK-AIR – from KLM, the pair operating on the airline's Berlin and Vienna services until 1938. The type, capable of carrying 12 passengers, was a refinement of Fokker's standard trimotor design, with wooden wings and a welded steel-tube fuselage.



CAPT DAVID WATSON COLLECTION



ABOVE LEFT The ČLS service handbook of 1935, bearing the airline's stylised bird logo and a pair of trimotors, the uppermost of which bears no resemblance to any aircraft in the airline's fleet! ABOVE RIGHT ČLS acquired its fleet of Douglas DC-2s – including OK-AIA, seen here at Prague circa 1936 – and DC-3s via Fokker before the war.

880kg (1,942lb) of freight and mail, covering a total distance of 82,435km (51,220 miles). The Avia aircraft company also operated a Prague—Liberec air parcel service for a short while in 1926.

### Expansion and competition

In May 1926 the Moravian capital of Brno (now part of the Czech Republic) was added to the existing line, and three years later this was further extended from Košice to Užhorod in Ukraine, on the border with Czechoslovakia. In 1929 ČSA signed up to the Warsaw Convention, which established rules relating to international carriage by air, and over the next couple of years the airline finally divested itself of its inadequate aircraft and began introducing more modern types, including the single-engined Aero A.23 and A.38 biplanes and A.35 monoplane, and four Fokker F.VIIB/3m monoplane trimotors.

A second Czech airline, Československá letecká společnost (ČLS), established by Škoda Auto, commenced subsidised operations on May 2, 1927, linking Prague with Halle/Leipzig using five-passenger Avia BH-25 single-engined biplanes. Concentrating on international routes, ČLS extended its overseas reach to Vienna, Paris, Berlin and Geneva, and from 1936, with a small fleet of Douglas DC-2s and DC-3s, participated

in the "Blue Danube Express", stretching from London to Budapest in Hungary in co-operation with Dutch airline KLM.

Although ČSA had been an early signatory to the 1919 Paris Convention governing the regulation of aerial navigation, only one of its nearby neighbours, Poland, ratified the treaty, which inhibited the airline's ambitions of operating beyond its borders. This changed on July 1, 1930, when ČSA established a service between Prague and Zagreb in Croatia, using a Ford Tri-Motor. Unfortunately the Ford crashed at Jihlava near Brno, while attempting to avoid bad weather. Despite this loss, the line was maintained and in June 1933 was extended to Sušak (now Rijeka) in Croatia. Known as the "Adriatic Express", the route was eventually lengthened to incorporate Split and Dubrovnik. A Saro Cloud amphibian, OK-BAK (formerly G-ACGO), was employed for this southward coastal run, since no suitable landing grounds were available. This aircraft was discovered derelict in 1977 and, after extensive restoration, the fuselage was put on display at the Kbely Aviation Museum in Prague.

Meanwhile, ČSA had taken delivery of an all-metal Caproni Ca 97 single-engined monoplane, OK-BEK, in October 1931. Another trimotor introduced around this time was the five-



**ABOVE** Of the 18 production Saro Cloud amphibians completed, only one was built as a civil aircraft, G-ACGO making its first flight on July 23, 1933. It was acquired in August 1934 by ČSA, which re-registered the aircraft as OK-BAK and replaced its original 340 h.p. Armstrong Siddeley Serval III engines with similar Walter Pollux radials.

passenger Letov Š.32 high-wing monoplane, suitable for night operations, which was placed on the summer route to the spa towns of Mariánské Lázně and Karlovy Vary. In the early 1930s radio direction-finding stations were installed at several key airports, permitting night and instrument flying which greatly improved safety and regularity. A lighted airway was also established between Prague and Bratislava.

### **The Great Depression**

Just as ČSA seemed to be going places, the country was hit by the economic recession in the wake of the Wall Street Crash in 1929. By 1933 industrial production in Czechoslovakia had fallen by 40 per cent and unemployment rose commensurately. Nevertheless, in September

1933, ČSA managed to open, at Košice, a spur off the main west-east

trunk route between Prague and Užhorod, onwards to Cluj in Transylvania and Bucharest in Romania. From 1935 the Czechoslovakian economy began to recover and on July 1 that year another significant domestic connection was made to Ostrava, an important coal-mining and steel-production centre close to the Polish border. Vienna also became a new international destination, flown via Piešťany and Bratislava.

Despite its motley assortment of largely inadequate aircraft, the airline contrived to make great strides, often under difficult conditions. A major step forward was made in September 1936 with the opening of a service to Moscow, in co-operation with Aeroflot. The 1,516-mile (2,440km) route — from Prague via Užhorod, Cluj, Iași, Kiev and Bryansk — was flown by a fleet of four British-built Airspeed Envoy in just 10hr and became known as the "Russian Express". Aeroflot's Tupolev ANT-9 could not match the

**Douglas DC-2 OK-AIB** was one of five operated by ČLS, along with four DC-3s, all of which were used on scheduled international services until Germany's occupation of Czechoslovakia in 1938, when both ČSA and ČLS were forced to cease operations. The ČLS fleet of Douglas transports was transferred to Deutsche Luft Hansa, none seeing service in Czechoslovakia after the war.

VIA MIROSLAV JINDRA





ABOVE The first of ČSA's fleet of four Airspeed Envoy Mk I OK-BAL arrived in Prague in August 1935, followed by Mk I OK-BAM the following month. The two remaining Envoy, Mk IIs OK-BAN and 'BAO, were delivered in 1936, all four of the airline's Envoy being powered by Czechoslovakian-built 340 h.p. Walter Castor II radials.

150 m.p.h. (240km/h) of ČSA's Envoy and was quickly replaced with a Douglas DC-2.

During 1935–37 ČSA modernised its fleet with two Dutch 17-passenger Fokker F.IXDs and six Italian SIAI-Marchetti S.73 trimotors. In April 1937 the latter inaugurated a line to Brussels in co-operation with Belgian national carrier Sabena, at which time cabin service was also introduced on main trunk routes. That same month, a major boost to the airline's fortunes came with the opening of Prague's new Ruzyně (now Václav Havel) Airport, affording greater opportunities for reciprocal traffic agreements. Quick to take advantage, ČSA began a service in May to Venice (and later Rome) via Bratislava, Klagenfurt and Trieste, in concert with Italian airline Ala Littoria. This was followed in July by Bucharest in pool with LARES of Romania and then Strasbourg and Paris in association with Air France.

Nor was the domestic network ignored, with new services to Zlín, Piešťany and Liberec established in the summer of 1938. Finally, on September 1 that year, ČSA joined with Sabena and LARES on a sector basis in the "Transeuropa Express", stretching from London to Bucharest. At around the same time, flights to Budapest began in conjunction with Hungary's Malert.

During 1933–38 ČSA enjoyed a remarkable 770 per cent increase in passenger-miles flown, and in 1938 the airline carried 33,000 passengers over a 3,725-mile (5,896km) route network — but this was to be the pre-war pinnacle of the airline's success and development.

### War clouds gather

The Munich Agreement of September 1938, which allowed Hitler's Germany to annex the German-speaking region of Czechoslovakia, the so-called

Sudetenland, had a profound effect not only on the republic, but also its airline. At a stroke, ČSA lost access to five airports: Karlovy Vary; Košice; Liberec; Mariánské Lázně and, effectively, Užhorod, leading to a suspension of all services for two weeks. Limited operations resumed on October 1 over routes to Bucharest and Paris and in November emergency and courier services were initiated to several points in Slovakia and south-western Ukraine. On October 22, 1938, Czechoslovakian President Edvard Beneš resigned and left for London aboard a CLS DC-3.

On March 15, 1939, German forces began occupying the rest of the Czech lands and a day later, Hitler proclaimed the Reich Protectorate of Bohemia and Moravia. With the country's capitulation, all civil flying ceased and in September 1939 ČSA was liquidated and its surviving fleet was transferred to the Luftwaffe. CLS was also forced to cease operations, and its aircraft were ceded to Deutsche Luft Hansa (DLH). Slovakia quickly elected to become a nominally independent state aligned to Germany and was allowed to resume air services. In June 1939 the Slovakian state had formed Slovenská letecká akciová společnost (SLAS), and at the end of the month services began to Bratislava and Vienna in conjunction with DLH using two Junkers Ju 86s. SLAS continued flying with a variety of aircraft to Vienna, Berlin, Budapest and on limited domestic services until the summer of 1944, when the advancing Soviet Army made continued operations unsustainable.

Soviet forces liberated Czechoslovakia in June 1945 and later that month the First Army Air Transportation Regiment began limited essential services to Bratislava and Belgrade using captured Junkers Ju 52/3m and Ju 252 transports along



CAPT DACRE WATSON COLLECTION

LEFT The cover of ČSA's May 1947 timetable carried an attractive design in which a plan view of a Douglas transport is arranged to represent an arrow from a bow. When ČSA was reactivated after the war, the airline took delivery of a large fleet of DC-3s, most of which were from USAAF surplus supplies.

Convention), during which the International Civil Aviation Organisation (ICAO) was established, the reconstituted airline became one of the latter's founding members.

### Post-war progress... and setbacks

The first regular commercial services into Prague were flown from Moscow by Aeroflot, and it was not until March 1946 — after receiving an initial batch of surplus USAAF Douglas C-47s — that the revitalised ČSA resumed operations. On March 1 the airline made its first post-war commercial flight, between Prague and Zürich, followed by Paris via Strasbourg three days later. On March 15 ČSA began taking over domestic routes from the military, as well as some Ju 52/3ms and several Siebel Si 204Ds. By the year's end, in pool with a number of national carriers, the airline was serving 11 of Europe's major capitals and cities, including London.

Having re-established itself in Europe, the airline began pushing eastwards, and in April 1947 commenced services to Cairo via Rome, Athens and Istanbul. Setting its sights much further afield, a long-distance DC-3 trial flight to Bombay was undertaken in February 1948, but no regular service ensued. Plans were also in hand for flights to North America using Douglas DC-4s in conjunction with Pan American. The purchase of DC-6s or Lockheed Constellations was also under consideration, but subsequent political events would put paid to these ambitious plans.

ČSA's timetable for June 1948 comprised 17 domestic and 24 international destinations stretching from Beirut in Lebanon and Lydda in Palestine to Helsinki, Nice and London. That year 116,000 revenue passengers were carried over an unduplicated route network of 11,800 miles (18,890km) by a fleet of around 30 aircraft.

Early in 1948 communist elements took over

with several examples of the Noorduyn Norseman.

By government decree in September 1945 the pre-war activities of ČSA, CLS and SLAS were combined into a new national enterprise — Československé Aerolinie (ČSA). Following the Convention on International Civil Aviation in the USA in 1944 (also known as the Chicago

**BELOW** Seen here at Copenhagen in the late 1940s or early 1950s, OK-WDU (c/n 9798) was one of ČSA's many ex-USAAF C-47As, joining the airline's fleet in September 1947. This aircraft went on to have a remarkably long career, later serving in France as F-GEOM and operating as G-OFON and G-DAKK in the UK until the early 2000s.

JOHN STROUD © A FLYING HISTORY LTD





ABOVE In June 1949 ČSA received the first of its Ilyushin Il-12Bs, an example of which, OK-DBN, is seen here at Stockholm in the early 1950s. A Soviet design for a DC-3 replacement, the Il-12 was not much of a leap forward, being unpressurised and powered by Shvetsov M-82 engines, very similar to the DC-3's Pratt & Whitney R-1830s.

the government and, under pressure from Stalin, aligned Czechoslovakia with the Soviet Union. This momentous political shift, effectively isolating the country from all but its ideologically compatible neighbours, soon had an equally profound effect on air transport.

Under the new regime Czechoslovakia was no longer an attractive proposition for foreign visitors and businesses. Coupled with an embargo by many of the country's previous trading partners, this sent ČSA's traffic levels plummeting. Over the next few years the airline effectively stagnated; international routes were cut by 40 per cent, while domestic destinations initially shrank to just four points, reducing the network by a factor of ten to just 4,338 miles (6,982km) over the next six years. Commensurately, during 1947–49 revenue passenger miles (RPM) dropped from 39 million to 25 million and losses increased from 18 million Czechoslovak koruna (CZK) to CZK52 million.

A new player appeared on the domestic scene in January 1948 when Svitlet opened a service between Zlín (Gottwaldov during 1949–90) and Prague. Originally created in 1924, Svitlet was the aviation division of the Bata industrial company, best known internationally for its shoes. The new service was initially run for its executives and salesmen, but in October 1949 this became a public transport service, expanded to two other cities, Prostějov and Bratislava, using DC-3s and Si 204Ds. Along with most of Czechoslovakia's industries, Bata was nationalised and thus Svitlet was rolled into ČSA in 1950.

By 1950 the only remaining connections to the West were the three main Nordic capitals, but even these were deleted a year later after West Germany prevented ČSA from overflying its territory. A small consolation came with new services to Vienna and East Berlin (Schönefeld)

in December 1950 and August 1952 respectively.

Other casualties of the regime change were the large numbers of aircrew, who, having served valiantly in Allied air forces during the Second World War, returned home to be regarded as "undesirables" by the authorities. Many fled the country, some using aircraft as a means of escape. On March 24, 1950, three ČSA DC-3s on domestic services from Brno, Ostrava and Bratislava were hijacked by their crews and flown to the USAF base at Erding, near Munich.

### Modernisation Soviet-style

Attempting to modernise its fleet, in June 1949 ČSA began taking delivery of ten Ilyushin Il-12Bs, which marked the beginning of reliance primarily on Soviet-built aircraft for the next 40 years.

In June 1951, in an attempt to resolve the difficulty over domestic services, a business air taxi service was started, *Letecký aerotaxiškový oddíl* (LAO), using indigenous Aero 45 and later Let L-200 Morava light twins to link 18 industrial centres to more than 70 locations throughout the country. LAO's headquarters was in Prague, but technical support was based in Slovakia. Hire charges were set at just CZK3/km.

By 1952, with the country largely cut off from trade with non-communist countries, a lack of spares to keep the DC-3 fleet airworthy was becoming an increasingly acute problem. This was overcome by obtaining six Lisunov Li-2s (licence-built DC-3s) from the USSR.

A thaw in international relations during the mid-1950s saw ČSA's fortunes begin to improve, and former connections with western Europe were gradually re-established, starting with Paris, in association with Air France. By 1956 the airline was again flying to 14 international and seven domestic destinations. Following the



**ABOVE** In 1951 ČSA established its LAO subsidiary as a form of corporate air taxi service, connecting industrial centres within Czechoslovakia by means of a fleet of twin-engined light aircraft, including Aero 45s, as seen here, and Let L-200 Moravas. The work was demanding and at times dangerous, often because of hijacking attempts.

creation of the Warsaw Pact in 1955, ČSA became a member of the "Six Pool" of eastern European airlines, established to co-ordinate regional air transport. The joint service to Moscow via Vilnius in Lithuania with Aeroflot was resumed and a Paris—Prague—Moscow—Peking service was also established in conjunction with Air France and Aeroflot.

Gradual modernisation began in 1957 with the acquisition of six pressurised 32-seat Ilyushin Il-14Ps (licence-built in Czechoslovakia as the Avia 14), followed by a further 21, including several converted to freighters, over successive years. A major step forward came with the introduction of ČSA's first Tupolev Tu-104A service on December 9, 1957, flying direct between Prague and Moscow, making the airline the sixth to operate commercial jet airliners on regular scheduled services. [See Miroslav Jindra's OK-Jet! The Tupolev Tu-104A in Czechoslovakia in TAH30 — Ed.] The modernisation programme allowed retirement of the ageing Li-2 and Il-12 fleet.

Able to spread its wings once more, ČSA again turned eastwards, its Tupolev jets serving

Bombay via Cairo from August 1959. Another new type, the turboprop Ilyushin Il-18, joined the fleet in early 1960 and began operating services to Baghdad via Athens and Damascus from June 25 the same year. However, the Il-18 had some deficiencies; apart from high fuel consumption, its radio-navigation equipment was not up to ICAO standards, precluding its operation to many international destinations. Nevertheless, over the next couple of years the new turboprop began flying as far as Bamako and Conakry in West Africa, Phnom Penh in Cambodia and Jakarta in Indonesia, although these routes were more a matter of political expediency than exploiting worthwhile passenger markets.

A notable event occurred on February 3, 1963, when a Bristol Britannia, leased from Cubana, inaugurated a service to Havana, fulfilling ČSA's long-held ambition to cross the Atlantic. With the addition of a second Britannia, flights were also made to Mexico City and Mérida in Mexico, some 6,000 passengers being carried in the first year of operation. Reciprocally, ČSA helped out with basic maintenance and spares acquisition

**From 1957 ČSA took delivery of an updated, pressurised version of the Il-12, licence-built in Czechoslovakia as the Avia 14P (P for passenger variant). This example, OK-MCL, seen here at Heathrow in September 1958, remained in the ČSA inventory until 1984. Note the revised tail surfaces compared to the Il-12B.**

PETER KEATING © A FLYING HISTORY LTD



*In January 1964 Bristol Britannia 318 OK-MBB became the second example of the type to be leased to ČSA from Cubana, with which it had been registered CU-T671. The two Britannias – the first, OK-MBA, had been leased the previous year – operated a Prague–Havana service via New York and Prestwick. After five years of ČSA service, OK-MBB was returned to Cubana in January 1969. TAH ARCHIVE*



DAVID H. STRINGER COLLECTION

for Cubana, which was struggling owing to the country's isolation in the wake of the revolution.

With continual expansion, especially in its short- and medium-haul routes, ČSA began looking for suitable equipment, and towards the end of 1964 took delivery of three Tu-124V jetliners, which offered the advantage of being able to operate into rough airfields. At this stage annual passenger uplift was approaching a million and the network covered some 59,000 miles (95,000km), encompassing 31 international and 11 domestic destinations. Work also began on lengthening the runways and the construction of a new terminal at Ruzyně.

### **Further into the jet age**

For some time ČSA had been seeking replacements for the depreciated Tu-104A and Il-18 fleets and was veering towards Western-designed aircraft. In the event, however, the airline again turned to the Soviet Union and ordered Tupolev's Tu-154M three-engined medium-range jetliner and smaller twin-engined Tu-134A, although production delays meant these would not be immediately

*LEFT The cover of an April 1958 ČSA promotional brochure celebrating the airline's entry into the jet age with the introduction of the Tu-104A from late 1957.*

available. For its long-range requirements ČSA chose the four-engined Ilyushin Il-62. With a range of 9,000km (5,600 miles) it was ideally suited to ČSA's longer routes to the Middle East and across the Atlantic to Cuba. Pending delayed delivery of the Il-62s, two examples were wet-leased (provision of aircraft, complete crew and maintenance) from Aeroflot in May 1968. Three months later the country was again plunged into turmoil when Warsaw Pact troops invaded Czechoslovakia in response to attempted political reforms known as "The Prague Spring". The effect on ČSA was a two-week shutdown which cost the airline approximately CZK200m.

ČSA began receiving its own Il-62s in November 1969 and the following May opened its long-anticipated service to Montreal and New York. Shortly afterwards, LAO was combined with Agrolet (ČSA's agricultural division) to form a single organisation, Slovair, which, using Czechoslovakian-designed twin-engined Let 410 feederliners, began developing a local feeder network of 11 destinations. Although it was now benefiting from its new Tu-134As, ČSA was still looking to replace its Avia 14s, and as a stopgap elected for the 32-seat tri-jet Yakovlev Yak-40, which entered service during 1973–74.

Through the 1970s ČSA's traffic prospects continued to improve, aided by joining the Société Internationale de Télécommunications Aéronautiques's 17-member Gabriel electronic reservations system in 1975. The reconstruction of Poprad-Tatry Airport in the Slovak ski resort, with a longer runway, enhanced the country's tourist business, with 1,800 charter flights completed in 1979 alone. However, by the end of the decade, a global economic recession and rising fuel prices again intervened, forcing ČSA to economise once more, eliminating a number of destinations

In 1964 ČSA introduced the Tupolev Tu-124V into service. Essentially a scaled-down version of the Tu-104A, with turbofan engines replacing the latter's turbojets, the Tu-124 could carry up to 56 passengers over short-range, mainly domestic routes. This example, OK-TEB, was delivered in November 1964 and was written off after landing with its undercarriage still retracted at Zürich on August 18, 1970. MIKE HOOKS



BELOW Ilyushin Il-18V OK-NAA, named Ostrava, joined the ČSA fleet in early January 1960, the type offering long-range turboprop services. This aircraft was damaged in a collision with a ČSA Tu-134 at Prague on January 2, 1977, but was repaired and returned to service. It was retired in 1981 to become an exhibit at the Kbely Aviation Museum.



MIKE HOOKS x 2

BELOW Wearing the airline's distinctive "OK jet" colour scheme of the 1970s, Tupolev Tu-134A OK-EFK taxis out at a European airport sometime after its delivery in November 1974. The Tu-134 was designed as a replacement for the short-range Tu-124 and was similarly rugged, although it was not economically efficient and was extremely noisy.





MIKE HOOKS

**ABOVE** With everything hanging out, ČSA Tupolev Tu-154M OK-SCA, named Mesto Piešťany, comes in to land in May 1989. The handsome tri-jet served as something of a workhorse for ČSA through the late 1980s and 1990s until the type's retirement in 2000.

**RIGHT** "OK means Carefully Serving Airline", according to this 1966 ČSA timetable.

and reducing frequencies. This was particularly evident in the domestic network, which faced a huge decline in passenger numbers, attracted away by the cheaper fares on buses and trains.

Throughout this period of austerity, although passenger numbers dropped by around a third, nevertheless ČSA managed to open new international routes and introduce Business Class services. It was not until 1988, however, that things started looking up and in February that year delivery of the airline's first Tu-154M took place. As part of the process of rebuilding the Czechoslovakian economy, it was decided to convert ČSA from a state-owned enterprise into a national joint stock company, allowing participation by private investors.

### A new dawn?

In November 1989, following events in the USSR, Czechoslovakia finally threw off the yoke of the ruling communist government and embarked on a journey of sweeping political and economic change. For ČSA, now subject to the vagaries of the market economy and lacking any financial reserves, it was not going to be an easy ride. On the plus side it was now able to make its own decisions free of state interference, and was no longer tied to purchasing Soviet equipment. Thus, early in 1991, ČSA obtained a pair of Airbus A310-300s to help expansion in wider Europe.

For economic and political reasons, services to Vietnam and Havana were terminated. However, Atlantic services were not completely abandoned and in May 1990 a Lockheed TriStar was wet-



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leased from American Trans Air (ATA) for flights between Prague and New York.

To ease its difficulties ČSA began looking for a strategic partner, and in March 1992 signed an agreement with Air France. The arrangement did not bear the expected fruit, however, and was terminated after just two years. Undaunted, ČSA embarked on a fleet modernisation programme, ordering ATR 72 turboprops and Boeing 737-400/500 jets. With sufficient numbers of more modern Western aircraft in place, most of the un-economic Russian aircraft had been withdrawn by 1995 — although it was not until 2000 that the last, a Tu-154M, was retired, with 51.3 million km (31.9 million miles) on the clock.

Meanwhile, late in 1992 the Czech and Slovak republics decided to go their separate ways, leading to ČSA being rebranded as České aerolinie a.s., or ČSA Czech Airlines, in March 1995. Three months later, Slovenské aerolínie a.s. (Slovak Airlines) likewise came into being. In April 1996



MIKE HOOKS x2

**ABOVE** In 1968 ČSA began operating the Ilyushin Il-62 on its long-haul routes, initially using a pair leased from Aeroflot, although the following year the airline began receiving its own examples. Named Košice, OK-ABD joined the fleet in December 1971 and is seen here coming in to land in April 1986, four months before its retirement.

ČSA forsook New York's JFK airport and began flying into Newark, New Jersey, after it had hooked up with American airline Continental. Although ČSA lost its connection to Chicago as a result, the collaboration opened up a number of important destinations in the USA through code-share. ČSA transported more than two million passengers in 1999; and, while this figure matched 1979 levels, the vast majority were now carried on international journeys.

### **Into the 21st Century**

After decades of struggling, things began looking up for ČSA in March 2001 when it became the fifth member of the SkyTeam Alliance, and a month later it became a founding member of SkyTeam

Cargo. Along with new terminals and continuous improvements to facilities at Ruzyně, a dedicated cargo terminal was opened in January 2004.

In 2006 ČSA took delivery of its first three new Airbus A319/320s, having taken delivery of the first of three A321s the previous year, and at the same time began focusing increasingly towards Russia with the introduction of four new code-shared destinations. Over the next couple of years several significant developments took place. In May 2007 ČSA began flying to Atlanta, Georgia, in co-operation with Delta, while in November that year a code-share with Emirates Sky Cargo resulted in the launch of the first Prague—Dubai—Hong Kong cargo flight. Six new destinations were opened in 2008, including three

**BETWEEN** With a new colour scheme by the early 1990s, and liberated from its commitment to buy Soviet types, ČSA set about modernising its fleet, acquiring ATR 42 and 72 turboprop regional airliners for its short-haul routes. This ATR 72-201, OK-XFD, named Mlada Boleslav, joined the fleet in May 1992 and served until it was sold in 2011.





ABOVE Three Airbus A321s were leased by ČSA in 2005, including OK-CEC, seen here in April 2006, and used until 2012. In 2021 the severely depleted post-Covid ČSA fleet comprises one A319 (OK-REQ), one A320 (OK-HEU), one Boeing 737-800 (OK-TST) and two ATR 72s (OK-NFU and 'NFV), with the latter pair due for imminent retirement.

to former Soviet states. For some time ČSA had consistently been the recipient of travel industry awards — but, contrary to the outward signs, all was far from well financially, despite carrying more than 1.5 million passengers annually.

Early in 2009 the Czech Ministry of Finance issued a tender for the purchase of a majority stake in the airline. Among the contenders were Aeroflot and the Air France-KLM Group, but after Air France withdrew and the others were rejected, the tender was withdrawn. Instead, a €100m medium-term loan was obtained from Osinek, a state-owned company, although this would have unforeseen repercussions.

Under fair-competition rules established by the European Union (EU), which the Czech Republic had joined in May 2004, any form of state aid amounting to subsidy was not permitted. In the case of ČSA, this automatically triggered an in-depth EU investigation early in 2011. Although the EU eventually concluded that, under the airline's restructuring plan (which shed half its personnel), the Osinek loan did not breach regulations, it would eventually lead to a change of ownership.

In March 2013 long-haul flights were resumed, with a service to Seoul in co-operation with Korean Air Lines (KAL), which leased one of its Airbus A330s for the purpose. This association resulted in KAL acquiring a 44 per cent holding in ČSA the following month and, through code share, afforded 18 new destinations in the Asia/Pacific region. A similar benefit accrued when Travel Service (SmartWings airline) acquired 34 per cent of ČSA's stock a year later, adding another 25 destinations in Europe. The balance was retained by Czech Aeroholdings, which

comprised Prague Airport, ČSA Czech Airlines Technics and ČSA Czech Airlines Handling.

In 2015, completing the transformation after seven years of losses, ČSA returned to financial stability with a profit of €8.25m. This improved situation was maintained through the following year. In late 2017 the Czech government decided to sell off its remaining 22 per cent holding, which was acquired by Travel Service, followed shortly by the acquisition of the KAL shares, making Travel Service the dominant shareholder.

After decades of struggle, ČSA had finally thrown off its negative "Eastern Bloc" image to become the nation's modern flag-carrier. In April 2018 it proudly celebrated its 95th birthday with a special livery and sightseeing flights over Prague. At the beginning of 2020 it was looking forward to delivery of recently-ordered Airbus A220s and A321XLRs, but its prospects were brought to a shuddering halt as the global virus pandemic took hold in the early months of the year. Within weeks ČSA lost more than 80 per cent of its traffic and revenue sources; and, while there was a slight improvement over the summer, by the autumn of 2020 only five of its 12 aircraft remained in service.

A modicum of relief came with the granting of "moratorium" status, affording protection from creditors, but this was due to expire at the time of writing in November 2020 and it remains to be seen whether this illustrious and historic airline will survive this latest crisis.



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# THE PALE BLUE LINE

## RAF COMBAT TOURS IN KOREA, 1950–53

Although the aerial campaign during the Korean conflict was largely an American affair, nearly 80 RAF pilots — and one from the Fleet Air Arm — participated in combat tours “in country”, flying the latest hardware against a determined enemy also equipped with state-of-the-art materiel. **MICHAEL NAPIER** explores the British contribution to the Korean air war



*The conflict in Korea was to a great extent a proxy war between East and West, with both Cold War adversaries testing their cutting-edge technological capabilities against the other. The USA's most advanced frontline fighter at the time was the North American F-86 Sabre, two 4th Fighter Interceptor Group (FIG) examples of which are seen here taking off in early 1951.*



NATIONAL MUSEUM OF THE USAF VIA AUTHOR

**T**WO DAYS AFTER the North Korean People's Army (KPA) invaded South Korea on Sunday, June 25, 1950, a meeting of the United Nations (UN) Security Council issued Resolution 83, which recommended "that the Members of the UN furnish such assistance to the Republic of Korea as may be necessary to repel the armed attack". In the next few days the British Army's 27th Infantry Brigade in Hong Kong was earmarked for deployment to Korea, and the Royal Navy aircraft carrier *HMS Triumph*, then on a Far East cruise, was diverted to join US Navy Task Force 77 in the Yellow Sea. The RAF sent three Short Sunderland maritime patrol flying-boats of the Far East Flying Boat Wing.

### FIGHTERS TO KOREA?

Already faced with "overstretch" owing to its global commitments, the RAF examined whether it might also be able to send jet combat aircraft to Korea. Chief of the Air Staff Marshal of the Royal Air Force Sir John Slessor wrote on July 17, 1950, that he was "examining whether and how we could help by providing one or more fighter ground-attack squadrons for Korea in reply to the United Nations appeal. We might raise units by some special measures such as a call for volunteers".<sup>1</sup> However, it soon became clear that no ground-attack squadrons could be spared. In the meantime, it was agreed that RAF aircrew on exchange postings with the USAF could fly combat operations if so required.

A direct link between London and the UN

Commander-in-Chief, Gen Douglas MacArthur, was established through Air Vice-Marshal (AVM) Cecil "Boy" Bouchier, who was sent to Japan to act as the British Chief of Staffs' representative. Recalled to duty from his recent retirement, Bouchier had previously served as Air Officer Commanding British Commonwealth Air Forces of Occupation, Japan. Having quickly gained the confidence of the American leadership, Bouchier sent the first of many insightful despatches home on August 5.<sup>2</sup>

Two more arrivals in Japan were Wg Cdr Peter Wykeham-Barnes on August 8 and Wg Cdr J.E. "Johnnie" Johnson on October 14. Wykeham-Barnes was chief test pilot at the Aeroplane & Armament Experimental Establishment (A&AEE) at Boscombe Down and a distinguished wartime fighter pilot. He had been sent to Korea at the request of the USAF to advise its Far East Air Force (FEAF) on night intruder operations. Johnson, with 38 confirmed kills to his credit, was the highest-scoring RAF fighter pilot of the Second World War and was on an exchange posting to the USAF's Tactical Air Command. As the Director of Operations (RAF), Air Cdre Denis Barnett, explained, it was "agreed that Johnson should go to Korea to be attached to AVM Bouchier's staff with the object of gathering together information about the Korean War, which will assist us to improve our operational and technical efficiency".<sup>3</sup>

The first RAF pilot to fly combat missions over Korea, however, was Wg Cdr Alan Boxer, who

**OPPOSITE PAGE** With an RAF roundel on his "bone dome", Flt Lt John Granville-White poses for a photograph in the cockpit of a USAF F-86. One of 77 RAF pilots who flew combat missions in Korea, Granville-White scored a MiG-15 kill while flying the F-86 with the 51st FIG on June 29, 1953. CHRIS GRANVILLE-WHITE / COLOUR BY RICHARD JAMES MOLLOY



GRAHAM PITCHFORK VIA AUTHOR

LEFT Renowned Second World War RAF pilot Wg Cdr J.E. "Johnny" Johnson DSO\*\* DFC\* receives his American Distinguished Flying Cross for flying combat missions over Korea in the twin-piston-engined Douglas RB-26 and Lockheed F-80C jet fighter during the early days of the conflict.

spotting aircraft were virtually immune to fire from the North Koreans, who were afraid of retaliation by fighter-bombers. He noted drily that "this information came too late to save me from the very severe mental strain of the C-47 ride with Gen Partridge".<sup>5</sup>

### BRITS INTO ACTION

By now the FEAF air campaign had forced the KPA to move only at night; but, because of the lack of expertise in the role, FEAF night intruder sorties were improvised in a haphazard manner, hence the request for Wykeham-Barnes to share his expertise. From Korea, Wykeham-Barnes reported to the 3rd BG at Johnson AFB, northwest of Tokyo, where he found two squadrons of Douglas B-26 Invaders, which worked the day and night roles alternately. The aircraft were elderly veterans of the Second World War and not well maintained. Wykeham-Barnes wrote that "this last was strikingly confirmed on my first sortie when an electrical-wiring fire developed during action over Korea, that would have destroyed the aircraft but for a massive fire extinguisher wielded with great dash by the navigator".

After flying a number of sorties over Korea, Wykeham-Barnes produced a short memo entitled *The Planning and Operation of Night Intruder Aircraft in the Korean Theatre of Operations*.<sup>6</sup> In response, the FEAF gratefully adopted all of the recommendations made by Wykeham-Barnes. Interestingly, however, another recommendation made by Wykeham-Barnes, that "one squadron of RAF [Bristol] Brigands operating in the Korean theatre would have produced a good effect out of all proportion to their fighting value" was not adopted by his own service. He was followed in post as an adviser on night intruder operations by another RAF pilot, Sqn Ldr H.E. "Joe" Bodien, who flew several B-26 missions between September 29 and November 14, 1950.<sup>7</sup> Bodien

was on an exchange posting flying Boeing B-29 Superfortresses with the USAF's 92nd Bomb Group (BG). A New Zealander, Boxer had spent much of the Second World War with Special Duties squadrons, flying agents of the Special Operations Executive into and out of occupied Europe. When the 92nd BG was tasked with moving to Japan at short notice in early July 1950, he was appointed project officer responsible for the move of personnel and spares to Japan. As the Assistant Operations Officer, Boxer was also responsible for much of the mission planning for the 92nd BG, and flew nine operational missions over Korea with the 326th Bomb Squadron (BS), including a mission to Seishin (now Chōngjin) on August 29, 1950, on which he was appointed deputy lead commander.<sup>4</sup>

Wykeham-Barnes visited General E.E. "Pat" Partridge, commander of the US Fifth Air Force, at his headquarters in Taegu, South Korea, on August 21, 1950, for a face-to-face briefing, after which Partridge insisted on flying him to Pusan in a Douglas C-47, via a tour of the KPA front lines at 1,500ft (450m). It was only after they had landed that Wykeham-Barnes was told that

**BELOW** A busy scene at Kimpo circa late 1951, with Gloster Meteors of the Royal Australian Air Force's No 77 Sqn in the distance and glass-nosed all-black Douglas B-26 Invaders to the right. The Australians began the Korean conflict with P-51 Mustangs, but acquired the Meteor F.8s from the UK and deployed 22 at Kimpo from July 1951.

TAH ARCHIVE





ABOVE *Conspicuous in his blue RAF uniform (sixth from left, standing), Sqn Ldr the Hon Michael Adderley poses in front of a Republic F-84E Thunderjet with personnel of the 523rd Fighter Escort Squadron (FES), 27th Fighter Escort Group (FEG), with which he served from the spring of 1951, ultimately earning several American medals.*

was another wartime nightfighter ace, with five kills to his credit and a distinguished record flying the Defiant and Mosquito.

Meanwhile, Johnnie Johnson flew a number of RB-26 sorties with the 162nd Tactical Reconnaissance Squadron (TRS), both in daytime and at night. These included a mission on October 27, when he flew deep behind enemy lines for a night photo-reconnaissance of Kanggye in North Korea, for which he was awarded an American Distinguished Flying Cross (DFC). He wrote of his RB-26 flights:

"It seemed odd to fly over those inhospitable hills, over a land stripped of all softness, as far north as the Yalu River, and not see another aeroplane once we had left the vicinity of the ground fighting. But, for the present, the sky was empty of enemy aeroplanes and except for a little flak there was no opposition. I took full advantage of this state of affairs and, apart from getting the feel of things, the B-26's long endurance helped me to watch the lively fighter-bombers at work."<sup>8</sup>

Johnson also flew the Lockheed F-80C Shooting Star jet fighter-bomber on ground-attack missions with the 49th Fighter Bomber Group (FBG).

### RAF ROTATIONS

Like Alan Boxer, more RAF officers' exchange postings to the USAF rotated through Japan and Korea for combat tours in early 1951. The previous summer Flt Lt Stephen Daniel had been posted to Victorville AFB in California to fly the North American F-86 Sabre.<sup>9</sup> The 30-year-old Daniel, described in British magazine *Flight* as "a tall, sandy-haired Scot from Dumfriesshire"<sup>10</sup>, was a very experienced wartime Spitfire pilot

who had commanded Nos 72 and 145 Sqns and had 16 kills to his credit. Daniel was detached to the 4th Fighter Interceptor Group (FIG)/334th Fighter Interceptor Squadron (FIS), based at K-13 (Suwon), for a combat tour in the Far East on February 25, 1951. By now the Chinese offensive was spent and the UN had managed to push the front lines further north. Daniel described his duties with the 334th FIS as "providing air cover for land forces" and confided to the *Flight* correspondent that he hoped "to get a crack at the MiGs soon". In fact, he was able to realise that hope a month later when he engaged a formation of MiG-15s on April 16 and claimed one aircraft damaged. Daniel completed his tour of operations over Korea in early May, but he remained in Japan briefly to take part in F-86/Gloster Meteor combat trials.

At about the same time three more RAF exchange pilots — Sqn Ldr the Hon Michael Charles Adderley and Flt Lts Desmond Hinton and Peter H.L. Scott — were flying ground-attack missions over Korea in the Republic F-84 Thunderjet. Adderley had just been posted to HQ FEAF Fighter Operational Requirements in Tokyo, but he was to spend the first four months of the posting flying a combat tour on the F-84E with the 27th Fighter Escort Group (FEG). His first operational sortie was flown on March 19, 1951, and during his tour he was awarded both the US Air Medal and the Bronze Star.<sup>11</sup> He was also awarded the American DFC for leading a mission on May 21, 1951, during which, in order to attack targets north of Seoul, he had to fly among the hills under a low cloudbase with rain bringing the visibility down to less than a mile.<sup>12</sup> However,



ABOVE In early 1951 Flt Lt Max Scannell AFC (left) was one of four RAF pilots sent to oversee the conversion of RAAF pilots from the P-51 to the Meteor. Here Scannell meets Hollywood film star Errol Flynn in front of a No 77 Sqn RAAF Meteor. On his return to the UK in July 1953, Scannell was appointed CO of Meteor-equipped No 41 Sqn.

his experiences led him to despise napalm, which he thought was an evil and abhorrent weapon.<sup>13</sup>

Peter Scott was flying the F-84D with the 78th Fighter Group (FG) at Hamilton AFB in California when he was detached to the 154th Fighter Squadron (Arkansas Air National Guard) in May 1951 to fly the F-84E from Itazuke, Japan. He later recalled:

"We'd fly up the Korean peninsula (after about 130 miles of sea to Pusan), contact and meet a [North American] AT-6 target-spotter, which directed us to the targets with smoke rockets. The front line was clearly marked for us with canvas matting. We never saw an enemy aircraft, but there was groundfire."<sup>14</sup>

The third F-84 pilot was Flt Lt Desmond F.W. Hinton DFC, who won his decoration in Burma in the Second World War and was serving with the 20th Fighter Bomber Group (FBG) at Shaw AFB in South Carolina.<sup>15</sup> After successfully completing one tour of operations in Korea, Hinton then volunteered for a second, but, tragically, was killed on January 2, 1952.<sup>16</sup> While flying an F-84E with the 49th FBG, Hinton was bombing the railway track just north of Sunan when he was shot down by anti-aircraft fire.

### METEOR BOYS

In February 1951 four RAF pilots — Flt Lts Maxwell Scannell, C.I. "Joe" Blyth and Frank Easley and Sgt R.L.R. "Reg" Lamb — were posted to Itazuke to help the pilots of No 77 Sqn Royal Australian Air Force (RAAF) convert from the

North American F-51 Mustang to the Gloster Meteor F.8.<sup>17</sup> The Meteors arrived a little later, by which time the four RAF men had already flown operational sorties in the F-51.<sup>18</sup> Led by Scannell and his team, the RAAF pilots successfully converted to the new aircraft and returned to operations on July 29, 1951. The RAF team stayed on, but unfortunately Reg Lamb became the first RAF pilot to be killed in Korea, on August 22, 1951, when he was involved in a mid-air collision during a formation recovery to K-14 (Kimp'o).

On December 21, 1951, Slessor informed Bouchier that "I have now asked Gen [Hoyt] Vandenberg [USAF Chief of Staff] if he will allow a certain [number] of RAF pilots to serve for limited periods with USAF squadrons in Korea to gain war experience, and his first reactions have been favourable".<sup>19</sup> The agreement came swiftly and, one week later, Slessor confirmed that the RAF was sending "four officers from CFE [all having flown the F-86 at the RAF's Central Fighter Establishment — CFE] to Korea at the end of January for two to three months".

The first team of RAF pilots from Fighter Command arrived in Korea on February 13, 1952, led by Wg Cdr J.R. "Johnny" Baldwin, a wartime Hawker Typhoon pilot described by one colleague as "the archetypal fighter pilot — slim, fair-haired, with a well-groomed moustache and features that were made for the cinema screen or a recruiting poster".<sup>20</sup> The team included Sqn Ldr William "Paddy" Harbison, who had flown Spitfires and Mustangs during the war and had



ABOVE Air Vice-Marshal Cecil "Boy" Bouchier (second from left) was the British Chief of Staff's representative to UN Commander-in-Chief Gen Douglas MacArthur. To the right of Bouchier is Flt Lt Rex Knight, part of the first team of RAF pilots to fly the F-86, and next to Knight is Col Francis "Gabby" Gabreski, commander of the 51st FIW.

previously flown the F-86 as an exchange pilot with the USAF. The other two members were Flt Lts Rex Knight and Brian Spragg, the latter another wartime Typhoon pilot who had flown the F-86 during trials at the CFE.

Before leaving for Korea, all four pilots had undergone a short familiarisation course on the F-86A with the 81st FIG at RAF Bentwaters, although the weather had limited them to just three flying hours each. After arriving in Seoul, the team was split into two, with Baldwin and Knight going to the 51st FIG at Suwon, 25 miles (40km) south of Seoul, and Harbison and Spragg to the 4th FIG at Kimpo, west of Seoul.<sup>21</sup>

Baldwin wrote that "the CFE team has been extremely well received by the Americans after a slightly sticky start . . . I have been asked to act as Group Operations Officer to the USAF 51st Fighter Interceptor Wing for the period of my stay. This is very flattering as the officer filling this post plans all operational missions and leads many of them".<sup>22</sup> He also added: "I would also like to say how extremely proud I am of the way the other members of the CFE team have buckled to and shown that the RAF is not lacking in pilot technique or guts. The result being that my team [is] equally popular with our American friends as companions in a fight against MiG-15s as they are socially on the ground".

At the 4th FIG Harbison reported that "our first impressions of Korea were severe. The weather was bitterly cold and I well remember shivering on the tarmac at K-16, the airfield at Seoul".<sup>23</sup>

Also attached to the 4th FIG was another RAF exchange pilot, Flt Lt Roy Lelong, who had arrived at Kimpo the previous month and would fly 27 operational missions over Korea.<sup>24</sup> A New Zealander from Auckland, Lelong was 33 years old and had been credited with seven confirmed kills while flying Mosquito night intruders during the Second World War.

Johnny Baldwin flew more than 12 combat missions, including one on March 6, 1952, for which he was awarded an American DFC. The citation described how he "displayed outstanding airmanship and tactical skill when his flight attacked a large force of 16-20 MiG-15s . . . and so aggressively pressed the attack upon the enemy flight that it was forced to withdraw". Unfortunately, however, he did not return from a sortie nine days later, possibly the victim of spatial disorientation, which can affect even the most experienced pilots. Baldwin's loss was felt deeply by Slessor who wrote, "what a tragic loss Johnny Baldwin was . . . I've known him since he was commanding a fighter-bomber Wing in 2nd Tactical Air Force and always regarded him as one of our very best".<sup>25</sup>

## THE NEXT BATCH

The second RAF team to visit Korea comprised Sqn Ldr John Merifield with Flt Lts A.F. Jenkins, J.M. Nicholls and D.A. Dunlop.<sup>26</sup> At 32, Merifield was the distinguished wartime Mosquito recce pilot who had taken the first photographs of a V1 missile on its launchpad, and who had



ABOVE A Douglas F3D Skyknight of US Marine Corps unit VMF(N)-513 over Korea. The first operational Skyknight mission by the unit in Korea was flown by RAF pilot Sqn Ldr J.R. Gard'ner in August 1952. Although lacking the glamour of the USAF's F-86, the Skyknight shot down more enemy aircraft in Korea than any other naval type.

subsequently set a transatlantic speed record. The team left England by sea on April 17, 1952, bound for the USA. Their first stop was Nellis AFB, Las Vegas, for a six-week conversion on to the F-86A, before arriving in Korea on June 19. Here the party split, with Merifield and Jenkins going to Suwon to join the 51st FIG and Nicholls and Dunlop joining the 4th FIG at Kimpo. "We all underwent further operational training and converted to the F-86E," reported Merifield, "the main difference between the A and the E models lying in the control system, which is entirely power-operated in the latter. We all flew 10–15 missions as No 2s and No 4s, then started leading elements and Flights".

By September 5 all the RAF pilots had flown at least 30 sorties and seen air combat, during which Merifield had damaged one MiG and Nicholls another two. Then, on his 99th mission, flown on December 8, John Nicholls scored a confirmed kill against a MiG-15. Another British pilot, Fleet Air Arm test pilot Lt-Cdr J.S. Bailey, also visited the 4th FIG to fly the Sabre in May and June, to report to the Admiralty on jet air combat.

Back in September 1951 Bouchier had proposed offering RAF Meteor pilots to fly operational tours with No 77 Sqn RAAF, but it was not until early 1952 that the offer was made to the Australians, who by then were running short of fighter pilots. The first six RAF pilots to join No 77 Sqn — Flt Lts J. Mellers, E.S. Chandler, M.O. Bergh, Fg Offs A.J. Hoogland, O.M. Cruickshank and W.G. Holmes — arrived at Kimpo in mid-1952. Another five RAF pilots arrived in October, followed by five more in November; over the course of the conflict some 30 RAF pilots flew combat tours with No 77 Sqn. Two of the first six pilots were lost in action: Oleof Bergh was shot down by groundfire on

August 27, 1952, and was taken prisoner by the North Koreans, while Jimmy Cruickshank was shot down and killed by Starshiy Leytenant F.P. Fedotov in a MiG-15bis of the Soviet Air Force's 518th IAP while returning from an attack against a target near Sinanju on October 2, 1952.<sup>27</sup>

When the US Marine Corps nightfighter squadron VMF(N)-513 at K-8 (Kunsan) converted to the Douglas F3D Skyknight in the summer of 1952, two RAF officers, Sqn Ldrs J.R. Gard'ner and N. Poole from the CFE, were tasked with performing a combat evaluation of the aircraft.<sup>28</sup> A New Zealander who had flown Defiant, Beaufighter and Mosquito nightfighters during the war, Gard'ner had the honour of flying the unit's first operational mission with the Skyknight over Korea on August 11. Both Gard'ner and Poole subsequently flew a number of operational night sorties.

Another RAF arrival at Kimpo in September 1952 was 32-year-old Flt Lt G.S. Hulse, a wartime Spitfire pilot who had served in Europe and the Far East. Described by his American colleagues as "a tall blond, affable veteran of the Battle of Britain [sic], [who] rapidly became one of our most admired and respected pilots," Graham "Blondie" Hulse was the most successful RAF F-86 pilot in Korea, being credited with 2½ confirmed kills.<sup>29</sup> He shared the destruction of a MiG-15 on October 25, 1952, and on December 9 was escorting a photo-reconnaissance aircraft at 30,000ft (9,000m) when he spotted a flight of MiG-15s climbing beneath them. "They were just across the Yalu at 5,000ft [1,500m]" he recalled, "so I dived after them and shot one down".<sup>30</sup> Unfortunately, Hulse's luck ran out on his 95th mission, flown on March 13, 1953, during which he was killed during a combat with MiG-15s;



PHIL WATSON VIA AUTHOR



**ABOVE LEFT** Flying Officer Roy Watson poses beside an F-84 of the 311th FBS in late 1952. **ABOVE RIGHT** About to clamber aboard No 77 Sqn Meteor A77-853, Fg Off Keith Williamson later rose to become Chief of the Air Staff during 1982-85. Note the "No Sweat!" artwork on the nose of the Meteor, which crashed at Kimpo in late 1953.

Sqn Ldr E.M. Higson described what happened:

"Graham attacked a MiG and set it on fire but expended his ammunition before the MiG was completely destroyed. He pulled off to the right and his No 2, [Maj E.M. Sommerich], started to fire at the MiG. His film, which I have seen, shows the MiG quite clearly. First of all, it's flying straight and level with smoke pouring from it. Then it banks to the right and you see Hulse's aircraft cross the screen from right to left slightly above and in front of the MiG. Then the MiG straightens out and fires three shots: you can see three puffs of smoke. Suddenly about 3ft [1m] of [Hulse's] port wingtip breaks away and he disappears off the screen, rolling on his back. The Major was not firing at the time the incident happened."<sup>31</sup>

The MiG-15 was finished off by Sommerich.

During the summer of 1952 a number of RAF pilots had answered the call for volunteers to fly combat tours in Korea: while some of them

joined No 77 Sqn RAAF to fly the Meteor, others were sent to USAF F-84 units. The latter included Fg Off Roy Watson, who flew his first mission with the 311th FBS on December 11, eventually completing his 100th mission on April 26, 1953.<sup>32</sup>

### LOSSES INCREASE

In the meantime, the RAF pilots flying the Meteor suffered a relatively high attrition rate, losing nearly one pilot per month to anti-aircraft fire during early 1953: Fg Off F.H.G. Booth went missing on January 27, while Fg Offs A.J. Rosser, R.L. James and G.P. Dollittle were killed on March 28, April 7 and May 17 respectively. Rather luckier was Fg Off J.R. Coleman, who ejected after his Meteor was damaged by groundfire near Seoul on June 22, but he was rescued by helicopter and was back on operations three days later.

The courage displayed in flying under such conditions was reflected by the award of the

**B BELOW** At least seven RAF pilots are readily identifiable by their lighter-coloured uniforms in this group photo of No 77 Sqn RAAF aircrew in front of a Meteor at Kimpo. Although No 77 Sqn had focused primarily on ground-attack duties with its P-51s initially, the arrival of the Meteor meant the unit could return to its pure fighter role.

77 SON RAAF VIA AUTHOR





ABOVE LEFT Flight Lieutenant Michael Whitworth-Jones, who won the DFC while serving with No 77 Sqn RAAF in Korea. ABOVE RIGHT A member of the third CFE team to arrive in Korea, Fit Lt "Jock" Maitland scored a probable MiG-15 kill during his tour. OPPOSITE An alphabetical list of the RAF and Royal Navy aircrew who fought in Korea.

DFC to Flt Lt M.E. Whitworth-Jones, whose citation stated that "despite extreme hazards of groundfire, mountainous terrain and treacherous weather, this officer has always displayed a conspicuous determination to inflict damage on the enemy and, through his skill and personal courage, has been outstandingly successful." Tragically, Mike Whitworth-Jones was killed in a flying accident in a de Havilland Venom during CFE ground-attack trials shortly after his return from Korea, aged only 27.

The third team from the CFE, comprising Flt Lts R. French, J.H.J. Lovell, J.R. "Jock" Maitland and J.L. Ryan, arrived in Korea on January 16, 1953.<sup>33</sup> All four were posted to the 51st FIG, but, as John Ryan recorded: "The three squadrons of the 51st FIG were hopelessly overmanned by pilots — the average number being 60-plus — and as a result missions were limited to 10–15 per month. The signing of the truce brought hostilities to an end before any member of the party had completed the recognised tour of 100 missions. However, by that time a score of one MiG destroyed (Flt Lt Lovell), one MiG probably destroyed (Flt Lt

Maitland) and one MiG damaged (Flt Lt French) had been recorded".

Ryan himself ejected from his Sabre on June 5 when the engine exploded over the mouth of the Chōngchōn river, but he was swiftly rescued.

### THE LAST SIX MONTHS

In December 1952 it had been agreed that a dozen RAF pilots would be posted to fly combat tours on the F-86 in Korea. The Air Ministry stipulated that "pilots [were] to have minimum 200hr jet experience, be volunteers and [be] recommended".<sup>34</sup> Sqn Ldr E.M. Higson was selected to lead ten more pilots to start a conversion to the F-86 in the USA on January 27, 1953, before deploying to Korea on April 5.<sup>35</sup>

Once in Korea, the pilots were split between the 4th and 51st FIGs. Despite the limited flying owing to chronic overmanning, Flt Lt R.J.F. Dickinson scored a confirmed MiG-15 kill on June 18 and Flt Lt J.H. Granville-White scored another on June 29. However, the combat losses were not one-sided; Flt Lt J.E.Y. King met his death after becoming separated from his flight in bad weather on June 4.

BELOW F-86Es 51-2784 and 50-648 of the 336th FIS, 4th FIW, come in to land at Kimpo after another interception sortie. By mid-1951 the original black-and-white identification stripes applied to USAF Sabres in Korea had been replaced with a solid yellow band around the mid-fuselage; 4th FIW aircraft also had yellow bands around the fin.

TAH ARCHIVE



Name	Rank	Service	Type	Unit	Service	Notes
Adderley, M.C.	Sqn Ldr	RAF	F-84	27th FEG	USAF	—
Almond, J.C.C.	Flt Lt	RAF	F3D-2	VMF(N) 513	USMC	—
Arnott, D.A.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Babst, E.F.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
Bailey, J.S.	Lt-Cdr	RN	F-86	4th FIG	USAF	—
Baldwin, J.R.	Wg Cdr	RAF	F-86	51st FIG	USAF	Killed in action, 15.3.52
Ball, B.J.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
Bayne, T.N.M.	Flt Lt	RAF	F-86	unknown	USAF	—
Bennett, R.L.	Flt Lt	RAF	F3D-2	VMF(N) 513	USMC	—
Bergh, M.O.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	Prisoner of war, 27.8.52
Blyth, C.I.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
Bodien, H.E.	Sqn Ldr	RAF	B-26	3rd BG	USAF	—
Booth, F.H.G.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	Killed in action, 1.53
Boxer, A.H.C.	Wg Cdr	RAF	B-29	92nd BG	USAF	—
Broad, R.N.	Fg Off	RAF	F-84	58th FBG	USAF	—
Burley, B.M.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Chandler, E.S.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
Chick, J.F.H.	Flt Lt	RAF	F-86	4th FIG	USAF	—
Christie, A.M.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Coleman, J.R.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Collins, G.A.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Cruickshank, O.M.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	Killed in action 2.10.52
Daniel, S.W.F.	Flt Lt	RAF	F-86	4th FIG	USAF	—
Devine, C.D.	Fg Off	RAF	F-86	4th FIG	USAF	—
Dickinson, R.J.F.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Dollittle, G.P.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	Killed in action 17.5.53
Downes, C.B.W.	Flt Lt	RAF	F-86	4th FIG	USAF	—
Dunlop, D.A.	Flt Lt	RAF	F-86	4th FIG	USAF	—
Eades, G.O.	Fg Off	RAF	F-84	58th FBG	USAF	—
Easley, F.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
French, R.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Gard'ner, J.R.	Flt Lt	RAF	F3D-2	VMF(N) 513	USMC	—
Gordon-Johnson, I.	Flt Lt	RAF	F-86	8th FBG	USAF	—
Granville-White, J.H.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Harbison, W.	Sqn Ldr	RAF	F-86	4th FIG	USAF	—
Higson, E.M	Sqn Ldr	RAF	F-86	4th FIG	USAF	—
Hinton, D.F.W.	Flt Lt	RAF	F-84	49th FBG	USAF	Killed in action, 2.1.52
Holmes, W.G.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Hoogland, A.J.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Hulse, G.S.	Sqn Ldr	RAF	F-86	4th FIG	USAF	Killed in action, 13.3.53
James, R.L.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	Killed in action, 7.4.53
Jenkins, A.F.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Johnson, J.E.	Wg Cdr	RAF	B-26	3rd BG	USAF	—
Johnston, I. L. M.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
King, J.E.Y.	Flt Lt	RAF	F-86	51st FIG	USAF	Killed in action, 4.6.53
Knight, R.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Lamb, R.L.R.	Sgt	RAF	Meteor	No 77 Sqn	RAAF	Killed in flying accident, 22.8.51
Lelong, R.E.	Flt Lt	RAF	F-86	4th FIG	USAF	—
Lovell, J.H.J.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Maitland, J.R.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Mansell, J.A.	Flt Lt	RAF	F-86	51st FIG	USAF	—
McElhaw, T.J.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Mellers, J.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
Merifield, J.R.H.	Sqn Ldr	RAF	F-86	51st FIG	USAF	—
Mollan, P.F.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Murphy, J.N.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Nicholls, J.M.	Flt Lt	RAF	F-86	4th FIG	USAF	—
Poole, N.	Sqn Ldr	RAF	F3D-2	VMF(N) 513	USMC	—
Price, J.W.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
Randle, W.S.O.	Sqn Ldr	RAF	H-19	3rd ARG	USAF	—
Rigby, W.T.L.	Fg Off	RAF	F-84	49th FBG	USAF	—
Rosser, A.J.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	Killed in action, 28.3.53
Ryan, J.L.	Flt Lt	RAF	F-86	51st FIG	USAF	—
Sawyer, P.G.	Flt Lt	RAF	F-86	4th FIG	USAF	—
Scannell, M.	Sqn Ldr	RAF	Meteor	No 77 Sqn	RAAF	—
Schwaiger, I.L.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Scott, P.H.L.	Flt Lt	RAF	F-84	136th FBG	USAF	—
Smith, B.N.	Fg Off	RAF	F-84	58th FBG	USAF	—
Smith, D.S.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Smith, R.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Spragg, B.J.	Sqn Ldr	RAF	F-86	4th FIG	USAF	—
Walker, J.J.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Watson, R.	Flt Lt	RAF	F-84	58th FBG	USAF	—
Whitworth-Jones, M.E.	Flt Lt	RAF	Meteor	No 77 Sqn	RAAF	—
Wilkinson, G.C.	Fg Off	RAF	F-86	unknown	USAF	—
Williamson, K.A.	Fg Off	RAF	Meteor	No 77 Sqn	RAAF	—
Wykeham-Barnes, P.G.	Wg Cdr	RAF	B-26	3rd BG	USAF	—
Yetman, F.B.	Flt Lt	RAF	F-84	58th FBG	USAF	—

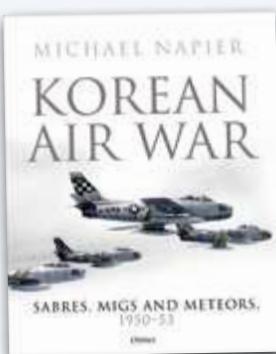


LEFT Looking none the worse for wear, Fg Off John Coleman disembarks from the Sikorsky H-5/HO3S-1 helicopter that rescued him when he was forced to eject from his No 77 Sqn Meteor near Seoul on June 22, 1953, after being hit by anti-aircraft fire.

RAF pilots continued to arrive in Korea until the armistice was signed on July 27, 1953. Earlier that month Fg Off R.N. Broad was one of four pilots who reported to K-2 (Taegu) to fly the F-84 and Flt Lts R.L. Bennett and J.C.C. Almond arrived from the CFE to fly the F3D on July 21. Bob Broad remembered:

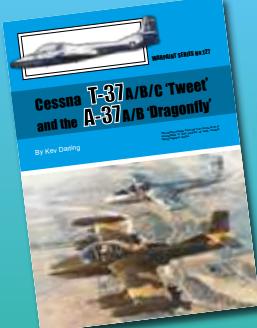
"Immediately we arrived it was made clear that we weren't going to fly in combat. Fifth Air Force had decided that as the war was coming to an end, and as most casualties happened to newcomers, they would avoid the inevitable losses due to inexperience and let the experienced pilots take the strain."<sup>36</sup>

In all, 77 RAF (and one Fleet Air Arm) aircrew flew combat operations with the USAF, USMC and RAAF during the Korean War, at the cost of ten killed and one prisoner of war.



MICHAEL NAPIER, a former RAF Tornado pilot, is the author of *In Cold War Skies: Nato and Soviet Air Power, 1949–1989* and the forthcoming *Korean Air War: Sabres, MiGs and Meteors, 1950–53*, both published by Osprey Publishing. For more information visit the Bloomsbury website — [www.bloomsbury.com](http://www.bloomsbury.com)

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## Cessna T-37 A/B/C 'Tweet' and A-37 A/B 'Dragonfly'

When USAF went searching for a new jet trainer in the early 1950's to replace the Lockheed T-33, it came as a great surprise to all when Cessna, best known for producing light aircraft, actually won the competition. Little did anyone realise that the T-37, the new training aircraft's designation, would stay in service for fifty years. Along the way the fleet had many rebuilds and is reckoned to have conservatively trained over 500,000 pilots to wings standard. Along the way it garnered many nicknames including 'Tweet', 'Tweety Bird' and the 'Screaming Dog Whistle'. Had the conflict in Vietnam been avoided this might of been the end of the line for the multi coloured trainer. As America became more involved with the conflict in South East Asia USAF was on a buying spree for all of the latest all singing, all dancing fighter attack aircraft. However, despite their supersonic capability and state of the art avionics these mighty behemoths were not suited to the close air support role. The answer would be to recall some stored early T-37's from the boneyard at Davis-Monthan and in consultation with Cessna turn the 'Tweet' into an attack aircraft. Few high tech gizmos were needed although the new fighter would sport a minigun in the nose. Pylons were added under the strengthened wings, tip tanks, from the T-37C, were added and engines with a bit more grunt were fitted. The designated unit destined to fly the A-37A 'Dragonfly' was the 8th Special Operations Squadron. Such was their dedication that a shack on the bombing range was used as a measuring point for bombing accuracy. They knew they had succeeded when one pilot blew up the shack exclaiming the 'SHACK' call over the radio very loudly. The A-37A was soon followed by the 'B' model that was vastly improved and went onto serve globally for many years especially in Latin American countries where a few linger on. This book is written by Kev Darling and is supported with artwork by John Fox.

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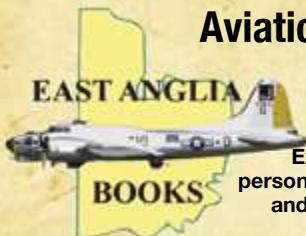
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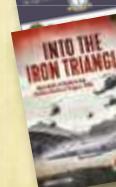
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# PERSIA'S ELEPHANTS

## THE BOEING 747 IN IRANIAN MILITARY SERVICE

When plans for the Imperial Iranian Air Force to acquire 12 Lockheed C-5A Galaxies in the mid-1970s fell through, the Iranian government took advantage of the ready availability of Boeing 747s being sold off by cash-strapped American airlines hit by the global oil crisis. **BABAK TAGHVAEE** profiles the career of the Jumbo as a military transport and tanker in Iran

**T**HE IRANIAN MILITARY air arm has been the sole operator of the world's largest tanker aircraft since 1976. Three former TWA Boeing 747-131Fs, converted by the manufacturer during 1975–76, remain in service with the Islamic Republic of Iran Air Force (IRIAF) as heavy tankers in 2021. The Iranian military has also operated 747 freighters, including the first hinged-nosed 747-2J9Fs, since 1975.

The IRIAF's Jumbos played a key role during the nation's 1980–88 war with Iraq — from airlifting soldiers to the front line and evacuating wounded troops, to airlifting military equipment (including Chengdu F-7N/FT-7N fighters from China and Scud ballistic missiles from Syria, Libya and North Korea) and refuelling McDonnell Douglas F-4Es and Grumman F-14As during operations.

In 1974 the Imperial Iranian Air Force (IIAF) was equipped with a fleet of 48 Lockheed C-130E/H Hercules, with two more C-130Hs to be delivered in May 1975. In addition to these, the IIAF received its final two of 20 Fokker F-27-400M/600s on September 11, 1974. To transport an Imperial Iranian Army Ground Force (IIGF) infantry battalion of nearly 800 soldiers and their weapons, a total of nine C-130s would be needed; to transport an entire infantry brigade to the front line would require the use of 36 Hercules, which could put unsustainable pressure on the IIAF's C-130 fleet during wartime. Therefore, the IIAF's generals planned to increase the fleet of C-130s from the projected 50 in 1975 to 150 by 1985.

Covering an area of more than 636,000 square miles (1,647,000km<sup>2</sup>), Iran is a large country, and armoured divisions could take days to deploy

*Seen here at McGuire AFB, New Jersey, in October 1975, 747-131F serial 5-280 wears its original Imperial Iranian Air Force (IIAF) colour scheme of white upper surfaces and silver undersides separated by a dark green cheatline, with roundels on the fuselage aft of the wings and Iranian flag on the fin. It was re-serialled 5-8101 in 1976.*

AUTHOR'S COLLECTION



*Formerly N93102 with TWA, 747-131F serial 5-285 takes on fuel from an IIAF KC-707 via its nose-mounted receptacle. The 747 was re-serialled 8-5106 in 1976 and was destroyed during an Iraqi Air Force bombing raid at Lake Urmia in northern Iran in November 1986.*

TAH ARCHIVE



their troops and heavy equipment to the front line in wartime. The largest item of military equipment the IIAF's Hercules could airlift in support of the IIIGF's armoured divisions was the Scorpion light tank. Thus Iranian government officials entered into negotiations with their American counterparts and Lockheed to explore the procurement of 12 examples of the C-5A Galaxy in September 1974.

Galaxy production, however, had been completed a few months before and the production line converted for construction of the L-1011 TriStar airliner. The cost of re-converting the production line back to Galaxy construction would be significant, resulting in an enormous increase in the cost of Iran's prospective C-5A purchase. As a result, the American government declined Iran's request, forcing General Hassan Toufanian, head of the Iranian Army's procurement office, to find another solution to the IIAF's transport requirements.

At that time several airlines in the USA were on the verge of bankruptcy owing to the Arab-imposed oil embargo and subsequent rise in price of aviation fuels. In order to survive, some of these airlines, including TWA and Continental Airlines, sought to divest part of their fleets of young 747s at competitive prices, thus presenting Iran with an opportunity to buy them as an alternative to the C-5A. Initially, the IIAF put forward a plan to acquire six ex-TWA 747-131s at a cost of \$99m (USD) in February 1975, but the order was ultimately increased to nine. These were:

- N93101 (c/n 19667/5);
- N93102 (c/n 19668/8);
- N93103 (c/n 19669/9);
- N53111 (c/n 19677/73);
- N53112 (c/n 19678/78);
- N93113 (c/n 20080/80);
- N93114 (c/n 20081/85);
- N93118 (c/n 20082/151);

■ N93119 (c/n 20083/153).

The IIAF also procured three Continental Airlines 747-124s:

- N26861 (c/n 19733/42);
- N26862 (c/n 19734/58);
- N26863 (c/n 19735/64).

Following the successful conclusion of negotiations, all were sent to Boeing at Seattle, where they were converted into freighters with a large cargo door in the port side of their fuselages.

## THE IIAF'S TANKERS

Back in 1971 the Iranian government had ordered six Boeing 707-3J9Cs, officially designated KC-707 tankers, from the USA, which were delivered during 1973-75. Later in 1975 six more were procured and another two were ordered in 1976. Of this total of 14, two were later converted into electronic intelligence and signals intelligence (ELINT/SIGINT) aircraft as part of Project *IBEX*, leaving 12 KC-707 tankers in IIAF service by 1979.

In 1975 the IIAF commanders decided to have three of the 747-131Fs converted to the tanker role, and also had the entire IIAF 747 fleet fitted with nose-mounted refuelling receptacles, which would enable them to receive fuel from each other and the KC-707s. Accordingly, Boeing was contracted to convert three of the ex-TWA 747-131s into KC-747s, the first of which was serial 5-282 (formerly N93113). The first test flights of 5-282 were performed in 1976, with an IIAF F-4 receiving fuel. Before the conversion of 5-282, the 747 prototype, N7470, had been equipped with a refuelling boom and operator's window for trials, although it was not capable of fuel transfer. Almost all aircraft types in USAF service, including the Lockheed SR-71A, completed dry-contact trials with N7470 as part of the USAF's Advanced Cargo Tanker Aircraft (ACTA) programme.

Following the conversion of 5-282, re-serialled 5-8103 in 1976, Boeing converted 5-8105 (formerly



**ABOVE** IIAF KC-747 serial 5-8107 refuels a trio of ECM pod-equipped McDonnell Douglas F-4E Phantom IIs of the USAF's 496th Tactical Fighter Squadron near the 7th Tactical Fighter Base at Shiraz during a CENTO exercise in August 1977. The Central Treaty Organisation was a military alliance between Iran, Iraq, Pakistan, Turkey and the UK, but which often also included American forces. AUTHOR'S COLLECTION

**RIGHT** By the end of October 1978 the IIAF had taken delivery of four of the five 747-2J9Fs ordered in 1976, all fitted with hinged nose-doors, as seen here yawning open. The four were serialled 5-8113 (seen here) to 5-8116; the fifth, intended to be 5-8117, was still under construction in the USA when the 1979 revolution occurred and it was never delivered.

N93114) and 5-8107 (formerly N93118) to KC-747s in 1976 and 1977 respectively. The IIAF planned to have three more of its 747-131Fs converted into tankers, but the Islamic Revolution of 1979 put paid to the idea.

## THE HINGED-NOSE FREIGHTERS

In 1976, a few months after receiving the former TWA and Continental 747s from Boeing, the Iranian government placed an order for four 747-200Fs, a special cargo variant equipped with a hinged-nose cargo door to enable the loading of large military freight such as aircraft, helicopters and tanks. To fund the procurement of these aircraft, designated 747-2J9Fs in Iranian service, the IIAF sold all three of the ex-Continental 747-124s (serials 5-8110 to 5-8112). In addition, one of the 747-131Fs, 5-8109 (c/n 20083/153, formerly N93119), was sold back to TWA.

The same year, a fifth 747-2J9F was ordered as an attrition replacement for 747-131F serial 5-8104, which crashed after lightning struck its airframe and ignited fuel vapour in the port wing fuel tanks while discharging through the wing's static discharger, causing an explosion which led to the detachment of the port wing. All 17 occupants of the aircraft lost their lives.



KEYAN TAVAKOLI

In 1978 the IIAF received the last three of the four ordered 747-2J9Fs, 5-8114 arriving on February 27; 5-8115 on September 28 and 5-8116 on October 23. The first, 5-8113, had been delivered on December 22, 1977. Between March 1978 and January 1979 the IIAF's fleet of 11 747s logged a total of 627 sorties, but their flying activity was stopped immediately after the Islamic revolution in February 1979. At that point the IIAF (to become the IRIAF after the revolution) had a total of nine airworthy 747s; one was undergoing maintenance and the other was awaiting spare parts.

When the Iran-Iraq War started on September 22, 1979, only seven of the 747s were operational, and all were only partly mission-capable (PMC) as their MTBO (mean time between overhaul) had been reached. Not even the younger 747-2J9Fs had passed their regular inspections, and were only airworthy by means of extensions.



JALAL KHATOONABADI

**“ IN THE WAKE OF THE REVOLUTION, ISLAMIC REGIME OFFICIALS DID THEIR BEST TO WEAKEN IRAN’S ARMED FORCES ”**

**LEFT** By early 1980 most of the IRIAF's KC-707s were overdue for overhaul and had been grounded, forcing the use of drogue-adapter kits on the KC-747s' refuelling booms in order to refuel the IRIAF's F-14A Tomcats.

Between April 1979 and March 1980 the IRIAF's 747s logged a mere 119 sorties. The fifth and final 747-2J9F ordered, to be serialled 5-8117, was still under construction at Boeing when the revolution occurred and was never delivered, the new Islamic regime refusing to pay \$20,586,700 for it, despite it being scheduled for delivery on September 26, 1979. Ultimately, Boeing sold the aircraft to Northwest Airlines in 1983, with which it was registered N630US.

### INTO ACTION WITH THE NEW REGIME

In the wake of the revolution, Islamic regime officials, including Ebrahim Yazdi, Deputy Prime Minister and Minister of Foreign Affairs during 1979, did their best to weaken Iran's armed forces. Yazdi tried to convince the new leader, Ayatollah Khomeini, to order the sale of all seven of IranAir's 747s — one 747-186B, two 747-286Bs and four 747SP-86s — and the IRIAF's four recently delivered 747-2J9Fs. As mentioned, the fifth 747-2J9F was cancelled, as was the acquisition of ground equipment and spare parts with a total value of \$10m. However, the IRIAF's commanders ultimately persuaded Khomeini not to sell the 747-2J9Fs but to transfer them to the IranAir fleet. As a result, 5-8114, 5-8115 and 5-8116 joined the latter, with which they served with civil registrations EP-ICA, 'ICB and 'ICC respectively.

On September 22, 1980, the Iraqi Air Force conducted a massive air counter-offensive named *Qadessiya*, to disable the runways and key facilities of eight IRIAF bases, one Islamic Republic of Iran Army Aviation (IRIAA) base and a civil airport. Four Tupolev Tu-22B jet bombers of the Iraqi Air Force's No 36 Sqn, based at Tammuz, bombed the 1st Tactical Fighter & Transport Base, part of Mehrabad International Airport in Tehran, at 1410hr local time.

As a result three KC-707 tankers were slightly damaged by shrapnel, another was heavily damaged and another destroyed, along with a C-130E. In addition, 747-131F serial 5-8106 was damaged by shrapnel but was repaired in a few days. To protect the 707s and 747s from the Iraqi air strikes, the IRIAF deployed them to Mashhad, north-east of Tehran, and Karachi in Pakistan for several months. Two 707s and two 747s were kept at Mashhad for refuelling and cargo missions.

The IRIAF's 747s went on to play an important role during the Iran-Iraq war, their two main roles being inflight refuelling and logistics support. For example, during September 27–29, 1981, the Islamic Republic of Iran Ground Force (IRIGF) launched Operation *Samen-ol-A'meh* (Eighth Imam), which led to the breaking of the siege of Abadan and the liberation of occupied territory in Khuzestan Province in south-west Iran. The

*Originally 5-281 in IIAF service, former TWA 747-131F was re-serialled 5-8102 in 1976, and is seen here the following year. This aircraft has not flown for some time and remains in a stored condition on the Karbor ramp at the IRIAF's 1st Tactical Fighter & Transport Base at Mehrabad International Airport in 2021.*

ERIK EZ





ABOVE In the wake of the 1979 revolution three of the IRIAF's four 747-2J9Fs were transferred to IranAir, including 8-5116, which acquired the civil registration EP-ICC, and which is seen here in full IranAir Cargo colours in February 1985. It was put into storage in late 2006 and is currently preserved at the Tehran Aerospace Exhibition Centre.

operation was undertaken by some 40,000 Iranian troops, including 15,000 outside the city. A few hours before the launch of the operation, the IRIAF's 747-131Fs airlifted thousands of soldiers of the IRIGF's 77th Infantry Division from Mashhad in north-eastern Iran to Omidiyeh in the south-west.

In 1980 the Iranian authorities decided to send military delegations to Lebanon through Syria, to help Lebanese Shi'ite militia groups during the civil war in Lebanon. As a result, hundreds of Islamic volunteers, mostly members of the Islamic Revolutionary Guard Corps (IRGC), led by commander Mostafa Chamran, were flown aboard IRIAF 747-131Fs to Damascus International Airport, from where they went to Lebanon in 1981. This also provided cover for the IRIAF to use its KC-747s during operations in the guise of civilian aircraft.

In 1982 the IRIAF's 747-131Fs transferred 650 volunteers, mostly belonging to the IRGC, to Damascus; these then helped the Syrian Arab Army and what became Hezbollah in Lebanon during the war with Israel. The latter, once one of Iran's allies during the secular government of the deposed Shah, was now a target of the new Islamist rulers of Iran.

### ATTACK ON H-3

The IRIAF's KC-747s were brought into action from day one during the war with Iraq, but the most significant milestone of their combat history is their role in the attack on Iraq's H-3 cluster of air bases at Al-Walid in the country's western corner, near its Jordanian and Syrian borders. The bases

had served as the depot for the Iraqi Air Force's aircraft since the beginning of the Iran-Iraq war, and provided a safe haven for Iraqi aircraft, especially the Iraqi Air Force's Tu-22 and Tu-16 strategic bombers, against the threat of IRIAF air raids. The air bases at Al-Walid — coded H-3A (H-3 north-east); H-3B (H-3 north-west) and H-3C (H-3 south-west) — were co-located within a 12-mile (19km) triangle.

Iran's unsuccessful attempts at the liberation of Khorramshahr in Khuzestan Province during the first six months of the war had severely lowered the morale of Iran's armed forces. In order to address this and provide an opportunity to raise morale again, the IRIAF designed an extremely complex air operation against the H-3 air bases. The operation would require the use of the IRIAF's KC-747s, which had sufficient range and endurance to support a long-range strike by the IRIAF's F-4Es.

The operation was undertaken on April 4, 1981, led by its planners Brigadier Fereidoun Izad-Seta and Brig Bahram Hooshyar. According to the former, who now lives in Los Angeles, the Syrian President, Hafez Assad, had refused permission for the IRIAF to use Syrian airspace for any attacks on Iraqi territory, this extending to refusing landing permission for IRIAF KC-747s at Damascus. Thinking laterally, Izad-Seta and Hooshyar arranged for a flight plan to be filed for a Tehran—Larnaca flight by one of the KC-747s, which, while overflying Syria, would declare a false emergency and land at Damascus, thus completing the first part of the plan. Iran's Ministry of Foreign Affairs then requested



ABOVE Four IRIAF KC-747 crew chiefs pose for a photograph in front of 5-8103, including Aflatoon Adhami (furthest left) who participated in the attack on H-3 as a boom operator refuelling IRIAF F-4Es at very low level.

BELOW Colonel Jalal Khatounabadi at the controls of an IRIAF 747-131F on a night mission during the Iran-Iraq War.

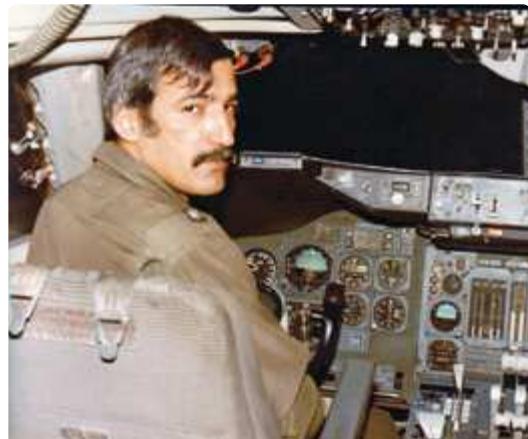
permission from the Syrian authorities to allow spare parts for the "grounded" KC-747 to be delivered in another Iranian 747.

The second aircraft, in fact another KC-747, arrived in Damascus during the week before the prospective attack on H-3, both remaining in the Syrian capital under the pretence of undertaking repairs. On April 4, the day of the proposed attack, the Iranians informed the Syrian authorities that they had completed repairs and that both aircraft were ready to return to Tehran.

Departing Damascus, the two KC-747s headed towards the Turkish border and descended to 200ft (60m), at which point they rendezvoused with eight IRIAF F-4Es, which were refuelled at low level before proceeding to their targets at Al-Walid. The H-3 base complex was bombed successfully, the Iraqis reporting the destruction of at least ten MiG-21s and Tu-22s, plus 15 Mil Mi-17 and Mi-2 helicopters, an ammunition depot and part of the airport navigation radar system.

Meanwhile, the two KC-747s continued circling at 200ft for more than 30min, after which seven of the F-4Es once again joined the pair of tankers to refuel and return to their base in Iran. One of the KC-747s then climbed to 18,000ft (5,500m) and contacted Damascus and Ankara air traffic control, stating that the aircraft had experienced pressurisation and communications problems, hence their low altitude and lack of transmissions, and returned to Iran.

The second KC-747, however, remained on station to refuel the eighth F-4E, piloted by Col Khazraiee, which was suffering a hydraulic failure and was unable to make it back to Tehran.



JALAL KHATOUNABADI COLLECTION

Both the KC-747 and the F-4E then climbed to 6,000ft (1,800m) and flew to Palmyra in central Syria, where the F-4E made an emergency landing while the KC-747 returned to Damascus.

The psychological impact of the operation was greater than the physical damage inflicted on the Iraqi Air Force. The operation had called on the services of ten F-4Es (two were reserves) of the 31st and 32nd TFSs armed with Mk 82 Snakeye general-purpose bombs and BL755 cluster bombs, the two KC-747 tankers and three Northrop F-5Es armed with Snakeyes. The F-5Es undertook a deception operation in northern Iraq to draw the attention of the Iraqi Air Force while the F-4Es were bombing the H-3 bases.

It took months for the IRIAF to repair the eighth F-4E, not helped by the fact that the Syrians



ERIK EZ

ABOVE 747-2J9F serial 5-8115, wearing its civil registration EP-SHA as well as the IRIAF legend on its fuselage, at Amsterdam in the early 1990s. Note the stylised tulip insignia painted on the fins of IRIAF 707s and 747s at that time, applied as a tribute to the Iranian war dead of the Iran-Iraq War. This aircraft is non-airworthy in 2021.

confiscated its external fuel tanks and refused Iran permission to retrieve the aircraft. The Syrian authorities also applied pressure on the Iranians to let them evaluate the aircraft during military exercises, with the Iranian machine playing the role of an Israeli Phantom. These frustrations led the IRIAF to mount Operation *Nejat-e Keshvar-e Narges* (Saving the Country of the Narcissus Flower) to bring the aircraft back home in 1982.

Accordingly, a KC-747 was sent to Syria, to be grounded there, again under the pretence of an engine fault, during Syrian air defence exercises. When the Iranian F-4E took off from Palmyra to play the role of an aggressor aircraft during an exercise (minus its auxiliary tanks to keep its range short), the KC-747 left Damascus to fly back to Tehran. The Iranian F-4E pilot then descended to 100ft (30m) and flew at very low level towards Turkey, where the KC-747 was waiting for him at 200ft (60m), the tanker providing the Phantom with fuel some six times on its flight back to the IRIAF's 3rd Tactical Fighter Base at Shahrokh. The Syrians believed — and may still believe — that the F-4E crashed in Iraq.

## THE LOSS OF 5-8106

The IRGC was a paramilitary force created to protect the Islamic government. During the Iran-Iraq war its largely inexperienced commanders led minor ground operations on the western and south-western fronts. While the majority of these operations ended in failure, some ended in victory, including Operation *Fat'h 3* in the Zakho and Duhok regions of Kurdistan in north-eastern Iraq, on November 17, 1986.

The IRGC, supported by Kurdish Peshmerga forces, employed guerrilla tactics to penetrate the region, sabotage government buildings and oil

facilities and leave, all within a 24hr period. In the course of the operation, they also managed to shoot down an Iraqi Army Mi-17 helicopter using man-portable air-defence systems (MANPADS). The IRGC commandos for the operation were originally planned to be sent from Tehran to Tabriz in north-western Iran aboard one of the IRIAF 747s. From Tabriz the commandos were to move to the Iraqi border by road. The IRGC's commander, Col Mohsen Rezaeie, requested Col Abbas Babaiee, an inexperienced IRIAF deputy of operations, to send the troops from Tehran to Lake Urmia instead, to reduce the road-travel time for the IRGC troops. Babaiee, who had recently been promoted from Captain to Colonel, largely owing to his loyalty to the Ayatollah, agreed.

For the flight to Lake Urmia, 747-131F serial 5-8106 was selected. Alarm bells rang immediately for the IRIAF commanders, who told Babaiee that sending a 747 to Lake Urmia was a mistake, as the airport was completely unprotected, while Tabriz International Airport was protected by two batteries of Rapier short-range surface-to-air missile (SAM) systems and a MIM-23B HAWK I medium-range SAM system. Nevertheless, Babaiee ignored this advice and ordered 5-8106 to fly from Tehran to Lake Urmia.

An hour after the 747 had landed at Lake Urmia an Iraqi fighter jet appeared over the airport and bombed the apron on which the 747 was parked. The attack failed to destroy the aircraft, but shrapnel damaged its undercarriage and one of its engines. The commander of the IRIAF 747 squadron requested new mainwheel tyres and a replacement JT9D-7A engine to be sent via C-130 from Tehran. It was not possible to replace the engine quickly, however, and he requested permission to fly the aircraft out on three engines



KEYVAN TAVAKKOLI

**ABOVE** KC-747 serial 5-8107, accompanied by a MiG-29UB (top), F-4E (middle) and F-14A, during an Iranian Military Day Parade in Tehran in April 2015. One of the IRIAF's three KC-747s, this aircraft has also used the civil registration EP-NHP since the early 1980s, but has been withdrawn from use and remains in storage today.

after removing all unnecessary equipment from the cabin to make it as light as possible for the return to Tehran. Babaie refused permission and the 747 remained at Lake Urmia — where it was was bombed and completely destroyed by Iraqi Air Force jets the following day.

### IRAQI AIRWAYS' JUMBOS IN IRIAF SERVICE

After the end of the Iran-Iraq war and just before the start of the First Gulf War in August 1990, Iraqi leader Saddam Hussein ordered the relocation of more than 140 military and civil aircraft from Iraq to Iran, in order to keep them safe from the airstrikes of the USA-led coalition's Operation Desert Storm during January–February 1991.

Accordingly, ten Iraqi Airways aircraft were sent to Iran, along with two previously captured IranAir aircraft — Boeing 727 EP-IRP and Airbus A300B2 EP-IBS — and an Iran Aseman Airlines' Dassault Falcon 20E, EP-FIF, which had been hijacked and flown to Iraq during the Iran-Iraq War. The Iraqi Airways aircraft comprised one 707-370C (YI-AGG), two 737-270Cs (YI-AGH and 'AGI), two 747-270Cs (YI-AGN and 'AGO) and five ex-Kuwait Airways Airbus A310-222s which the Iraqi government had seized and allocated to Iraqi Airways after occupying Kuwait in August 1990. A decision was made to put these aircraft into Iranian service as part of a multi-billion-dollar compensation deal which Iran was seeking from Iraq over starting the Iran-Iraq War in September 1980. The two 737-270Cs and 747-270C YI-AGO were delivered to IranAir, while 707 YI-AGG and 747-270C YI-AGN entered IRIAF service with the respective serials 5-8315 and 5-8106 (a second iteration of the latter serial). After a year, YI-AGO was also transferred to the IRIAF (but never given a military serial), after

IranAir failed to operate it for *Hajj* (pilgrimage) flights abroad, as the Iraqi government had filed a complaint to the United Nations for the seizure and return of these aircraft.

Owing to its fully passenger-configured cabin, 5-8106 continued in IRIAF service and was used by IRIAF-owned domestic airline Saha Airlines to fly passengers during the high-density spring and summer seasons between Tehran and Mashhad, as well as transporting IRIAF personnel and their families between bases. The original Iraqi Airways cabin décor remains.

In February 2012 the IRIAF purchased a 35-year-old Djibouti-registered 747-238B, J2-KCB (c/n 21352/310), from the Iranian FARSCO Aviation MRO Center organisation, for use as a spare parts source for the overhaul of 747s 5-8113 and 5-8114. In addition to J2-KCB, the IRIAF has been using former Iraqi Airways 747 YI-AGO as a spares source since 2006. The latter has been cannibalised comprehensively to keep its sister aircraft, YI-AGN/5-8106, operational.

### DWINDLING SERVICEABILITY

Of the IRIAF's ten 747-131Fs (including the three KC-747s), one 747-270C and three 747-2J9Fs, only three — 747-2J9Fs serials 5-8113 and 5-8114 and KC-747 5-8103 — are currently operational. The last-noted was overhauled and upgraded at FARSCO during January 2010–March 2015, and is mostly used for domestic IRIAF logistics support flights and aerial refuelling support for the IRIAF's F-4D/Es and RF-4Es, alongside two airworthy KC-707s.

At the time of writing (August 2020), the IRIAF had three more 747s under D-Check (heavy maintenance check): KC-747 serial 5-8107 at the "Revolution" maintenance hangar at Mehrabad,

# IRAN'S MILITARY BOEING 747 FLEET



IIAF/IRIAF serial	Boeing model	Original IIAF serial	c/n	Former operator	Former reg'n	First flight	Delivery date	Fate
5-8101	747-131F	5-280	19667/5	TWA	N93101	13.7.69	3.75	Stored
5-8102	747-131F	5-281	19678/78	TWA	N53112	24.9.70	3.75	Stored
5-8103*	747-131F	5-282	20080/80	TWA	N93113	5.10.70	5.75	Operational
5-8104	747-131F	5-283	19677/73	TWA	N53111	15.9.70	11.75	Destroyed, 9.5.76
5-8105*	747-131F	5-284	20081/85	TWA	N93114	17.10.70	11.75	NORM**
5-8106 (1)	747-131F	5-285	19668/8	TWA	N93102	7.12.69	11.75	Destroyed, 17.11.86
5-8107*	747-131F	5-286	20082/151	TWA	N93118	4.8.71	12.75	Stored
5-8108	747-131F	5-287	19669/9	TWA	N93103	5.12.69	12.75	Stored
5-8109	747-131F	5-288	20083/153	TWA	N93119	18.8.71	12.75	Sold back to TWA
5-8110	747-124	5-289	19733/42	Continental Airlines	N26861	2.5.70	1.76	Sold to Boeing
5-8111	747-124	5-290	19734/58	Continental Airlines	N26862	2.7.70	1.76	Sold to Boeing
5-8112	747-124	5-291	19735/64	Continental Airlines	N26863	17.7.70	1.76	Sold to Boeing
5-8113	747-2J9F	—	21486/315	—	—	28.11.77	22.12.77	Operational
5-8114	747-2J9F	—	21487/319	—	—	16.2.78	27.2.78	Operational
5-8115	747-2J9F	—	21597/340	—	N8277V	18.9.78	28.8.78	NORM
5-8116	747-2J9F	—	21514/343	—	N8293V	11.10.78	23.10.78	Transferred to IranAir
5-8117	747-2J9F	—	21668/400	—	N1288E	17.9.79	Not dlv'd	Sold to Northwest Airlines
5-8106 (2)	747-270C	—	21180/287	Iraqi Airways	YI-AGN	27.5.76	1996	NORM
—	747-270C	—	21181/289	Iraqi Airways	YI-AGO	21.6.76	1996	Broken up for spares
—	747-238B	—	21352/310	Buraq Air	J2-KCB	11.7.77	2.2012	Broken up for spares

\* Converted to KC-747 tanker \*\* NORM = Not operational, ready for maintenance

and 747-2J9F serial 5-8115 and 747-270C serial 5-8106 at FARSCO. The D-Check of the latter was completed in mid-August and the aircraft was towed to an area of Mehrabad International Airport for an engine test on August 16, 2020. Unfortunately, owing to negligence on the part of the technicians, the 747 jumped its chocks while running at full power and ran into a fence, resulting in significant damage to all four of the aircraft's engines, its nose section and leading-edge flaps.

**BELOW** *Crunch! On August 16, 2020, former Iraqi Airways 747-270C YI-AGN, serialled 5-8106 in IRIAF service, was substantially damaged when an engine run-up went awry at Mehrabad International Airport. Note the severe damage to the nacelles, leading edge and fuselage as it is towed back to the FARSCO Aviation MRO Center.*

ALI NADERI

In addition to the 747s, the IRIAF has a fleet of six Ilyushin Il-76TDs on strength with the 71st Tactical Transport Squadron (TTS) at the 7th Tactical Fighter Base at Shiraz, along with 20 C-130Es and 15 C-130Hs operating with the 11th, 12th and 72nd TTSs, and 13 Fokker F-27-400M/600 light transports serving with the 11th F-27 Squadron.

It is worth noting that only three of the Il-76TDs, 15 of the C-130E/Hs and three of the F-27s were airworthy at the time of writing.



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# BOAC

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## & THE BRABAZON COMMITTEE

In TAH33 Professor Keith Hayward marked the 75th anniversary of the publication of the final report of the Brabazon Committee with an analysis of the prevailing political weather. As a follow-up, **RALPH PEGRAM** uses contemporary documents — most previously unpublished — to examine BOAC's often conflicting perspective on its post-war hardware requirements

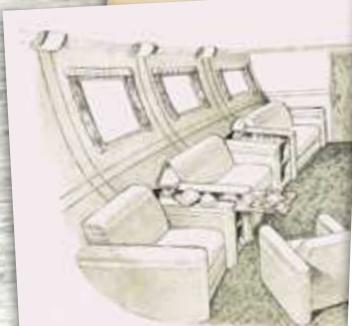
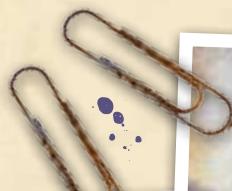


Fig. 20  
INTERIOR OF LADIES LOUNGE

THE BRITISH OVERSEAS Airways Corporation (BOAC) had the misfortune to be created through the forced merger of Imperial Airways and British Airways in the weeks following the outbreak of the Second World War. With many aircraft requisitioned, significant numbers of staff called up for military service and routes disrupted, the organisation struggled to consolidate under new management. To add to its woes, conflict with the newly formed RAF Transport Command in 1943 resulted in the resignation of the entire board. The Corporation was in poor shape and, urgent as it was, this was an inopportune time for the government to address post-war civil aviation requirements. The company found itself at cross-purposes with the committee chaired by Lord Brabazon of Tara tasked with outlining a way forward for new transport aircraft, and both groups felt detached from the decision-makers in the government. It was a recipe for confusion and wasted effort.

### THE BRABAZON COMMITTEE

The first Brabazon Committee, officially the Transport Aircraft Committee, was convened in the closing days of 1942 by Secretary of State for Air Sir Archibald Sinclair and Minister for Aircraft Production Sir Stafford Cripps. The six-man committee drew its members from within the senior ranks of the Air Ministry (AM) and Ministry of Aircraft Production (MAP). Its terms of reference were threefold, of which the first part was most pressing:

- i) to prepare outline specifications of the several aircraft types that would be needed for post-war transport;
- ii) to suggest which firms should be invited, as soon as urgent war work permitted, to prepare tender designs;
- to consider, in consultation with the aircraft firms concerned, which existing aircraft types could usefully be converted to air transport purposes for use while new-type civil aircraft were being produced, and to plan for such conversion;
- to prepare a plan for the immediate utilisation, in the interests of post-war air transport, of spare design and productive capacity while the aircraft industry was in transition from war to peace.

The Committee was tasked with achieving all of this within a month and in secret. Naturally, and despite the acknowledged expertise of the members, it was a mission of some magnitude to address many years of near-neglect of civil

aircraft by the government, and to a degree by industry, as the focus of both had shifted to rearment. The first weeks of the Committee's work involved gathering data on current aircraft and engines, both British and American, and on global pre-war passenger services. Thus it was only by the second week of January 1943 that the Committee was able to engage with industry and customers to solicit the latter's views.

A questionnaire sent to the Society of British Aircraft Constructors (SBAC) asked for its opinion on what could be achieved within three, five and ten years of the end of the war. The organisation forwarded this to selected firms and answers were received from eight.

### THE BOAC PERSPECTIVE

In the meantime BOAC submitted a paper outlining its ideas on how services should be developed in the five years after the war using existing and converted aircraft types. The Corporation's priority was to rebuild professional knowledge of airline operation, much of which had been lost owing to the war. During this period BOAC also intended to be closely involved in the investigation, design, construction, testing and introduction into service of new types of aircraft. However, it did not believe it was yet in a position to look beyond five years, as it was not in possession of all the latest technical knowledge; understandable but somewhat unhelpful for the Committee and a source of problems to come.

By the end of January 1943 the Brabazon Committee had written, amended and rejected several drafts of its recommendations as it struggled both with the conflicting advice it had received and the high number of unknowns, not least of which was the likely duration of the war and how this may affect the resources that could be allocated to civil aircraft designs. Comments criticising the lack of government policy around which to formulate the Committee's recommendations were excised, and sections speculating on the future prospects of the aircraft industry were watered down. However, the Committee was firm on the central recommendation that work should commence immediately on the design of five new aircraft types, albeit that there had been insufficient time to produce draft specifications for them, which, the Committee stated, would better be done jointly by the potential users and constructors. As a consequence, it was also unable to recommend which firms should be invited to tender designs.

It is hard to criticise the Committee for these shortfalls and it should have been obvious that

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**OPPOSITE PAGE, BOTTOM** One of the companies that sought to fulfil the potentially lucrative "DC-3 replacement" requirement was Miles Aircraft Ltd, which had been exploring "blended wing" designs for some time (as seen in the wing-cabin drawing at LEFT), and which in August 1944 fielded a brochure for its M.56 24-seat airliner (RIGHT).

## INITIAL BRABAZON COMMITTEE RECOMMENDATIONS

Type	Route	All-up weight*	Engines	Still-air range	Passengers
I	London—New York	150,000lb (68,000kg)	6–8	5,000 miles (8,000km)	Greatest possible
II	Europe & Feeder	24,000lb (11,000kg)	2	1,000–1,750 miles (1,600–2,800km)	20
III	Empire trunk routes	81,000lb (37,000kg)	4	3,500 miles (5,600km)	Greatest possible
IV	Transatlantic	39,000lb (18,000kg)	—	—	Mailplane
V	Britain & Colonies	12,000lb (5,400kg)	2	1,000 miles (1,600km)	12

more time and consultation was required to develop more structured recommendations, yet in March 1943 Sinclair announced that the Committee had completed its task and that work would commence on a limited number of projects "as and when it could be arranged without interfering with work on aircraft required for the war". The details were neither distributed to industry nor made public; there was, after all, not much to report.

Lord Brabazon was asked to head an expanded second Committee, this time including representatives from the aircraft industry and BOAC, to move the process forward. The five aircraft recommended by the First Committee, referred to as the Brabazon Types, formed the basis for the Second Committee's deliberations. Within the government, a parallel committee was set up to take decisions based on the recommendations of Brabazon's group, including Sinclair and Cripps and chaired by Lord Beaverbrook. [See Professor Keith Hayward's political analysis of the Brabazon Committee's work in TAH33 — Ed.]

Meanwhile, as the First Committee was apply-

ing the finishing touches to its recommendations, BOAC established its own Development Committee, and, unaware of the five Brabazon Types, was busy drawing up indicative specifications for aircraft appropriate for post-war operations along existing and expected routes. Needless to say, these two lists did not align too closely. By mid-1943, with the Second Committee in session and now informed of the First Committee's recommendations, BOAC had settled on four Types, A to D, that on the basis of routes corresponded to the Brabazon Types as per the table **ABOVE**. Much remained to be done if BOAC and the Brabazon Committee were to reach agreement. It is noteworthy that BOAC had given little thought to short-range aircraft and neither group had included a flying-boat.

### CONFLICTING OBJECTIVES

The Brabazon Types were numbered in order of perceived priority based on an assessment of development time, route requirements and opportunity to gain a lead in the market. Brabazon Type I received immediate government

**BELOW** While the production of brand-new types for BOAC would take time to gear up after the end of the war, the Corporation would need interim aircraft to maintain its services. This led to the conversion of military types, including 12 Handley Page Halifax C.VIIs, the first of which, G-AHDU, named Falkirk, became BOAC's first Halton.

TAH ARCHIVE



## BOAC PLANS, CIRCA MID-1943

Type	Route	Empty weight	All-up weight	Engines	Still-air range	Passengers
A	London—New York	79,000lb (36,000kg)	155,000lb (70,000kg)	6	4,700 miles (7,600km)	26
D	Europe & Feeder	23,000lb (10,400kg)	33,000lb (15,000kg)	2–4	1,000 miles (1,600km)	20
C	Medium Empire & Europe		70,000lb (32,000kg)	4	1,250 miles (2,000km)	23–40
B	Long-stage Empire	57,000lb (26,000kg)	102,000lb (46,000kg)	4	3,000 miles (4,800km)	24

COMPILED BY RALPH PEGRAM

approval for design work to commence, but, contrary to the Committee's advice, was assigned to Bristol without competitive tender. Bristol's views on the design of such an aircraft had been outlined in the SBAC feedback and considered by the Committee as both too large and too closely aligned with bomber design, something other companies had cautioned against. Leaks and rumours regarding the project reached the press by mid-1943, and despite comments from Bristol that they were "unauthorised and incorrect", articles in the technical journals were not far off the mark; it was indeed an eight-engined 100+-ton monster. The aircraft industry was not particularly impressed, neither with Bristol's concept nor with the government's decision not to invite tenders. BOAC, whose Type A was notably smaller, appears to have shown limited interest while it prioritised Types B, C and D. Yet work on the Bristol Type 167 "Brabazon" moved ahead, counter to the Committee's advice and with lukewarm support from the customer.

BOAC's technical advice was provided by a group headed by Maj Robert Mayo, formerly General Manager (Technical) of Imperial Airways Ltd (IAL). The group's analysis was built from the ground up; looking at the specifics of route stage-lengths, estimates of passenger numbers and freight for each, and the requirements for the carriage of air mail. Types C and D, roughly the equivalent of Brabazon Type II, became the main focus of its attention in the second half of 1943. Mayo saw little performance difference for a 20-seat Type D aircraft on a 600-mile (970km) route when powered by either two (Bristol Hercules) or four (Pratt & Whitney Twin Wasp Jr) engines, and BOAC was still undecided when, in early October, it was in receipt of a paper from Christchurch-based Airspeed (1934) Ltd.

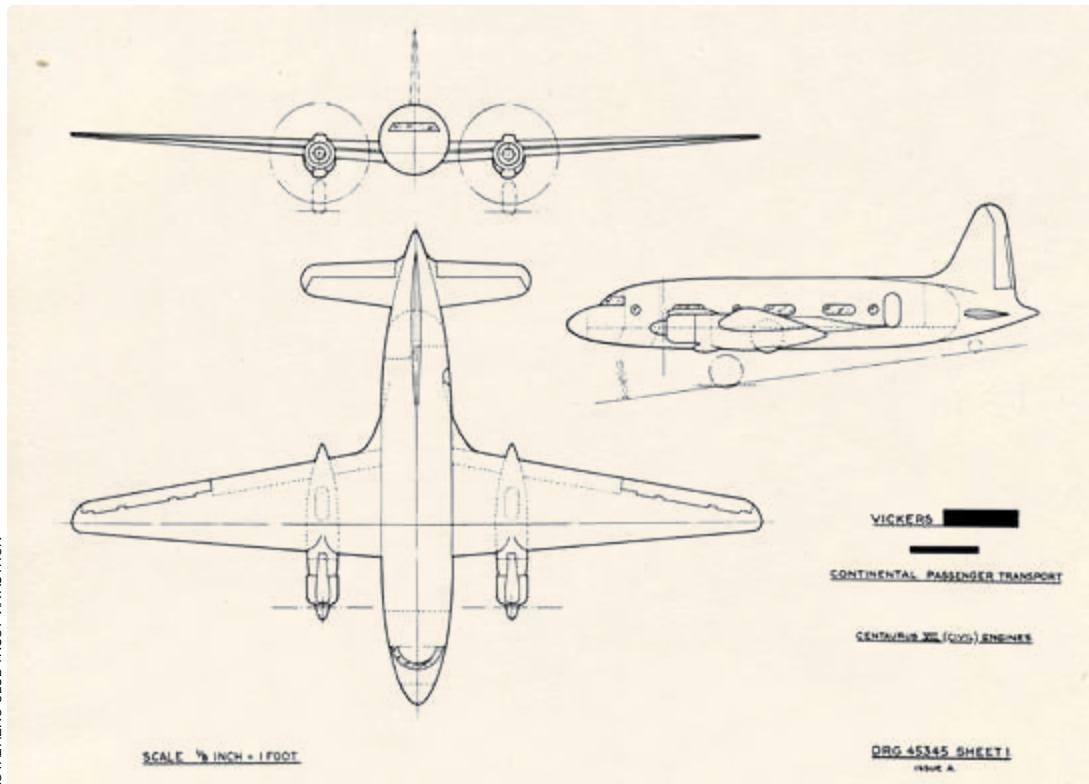
Airspeed had been provisionally assigned the Brabazon Type II project, described as a 20-seat

twin-engined "DC-3 Type", and considered first how this should be powered. The manufacturer suggested a rule-of-thumb formula "which broadly expresses the h.p. one can take out of a given engine with equal wear qualities or hours between overhaul comparable to another engine", before selecting the 22-seat de Havilland D.H.91 Albatross — the pre-war four-engined airliner designed by Arthur Hagg, Airspeed's new chief designer — as the best example of aerodynamic cleanliness. From this the company calculated that such an aircraft powered by two Bristol Hercules engines did not result in a noticeable improvement in performance. The conclusion therefore was that with more powerful engines, such as the Bristol Centaurus or Rolls-Royce Exe, the aircraft would be faster than the Albatross and able to carry 32 passengers for some 1,000 miles (1,600km).

BOAC was in agreement regarding the increase in capacity over the Brabazon Type II, which mirrored its revised view of Type D as a 40,000lb (18,100kg) aircraft for 24–30 passengers, but Mayo still had reservations about accepting twin-engined types on the grounds of safety. Nevertheless, Airspeed's twin-Centaurus AS.57 project was approved by the government for further work. Once

**Major Robert Hobart Mayo** joined IAL as a Consulting Engineer in 1924 and is probably best known for his 1930s concept of the composite aircraft, which culminated in the development of the Short Mayo Composite duo.



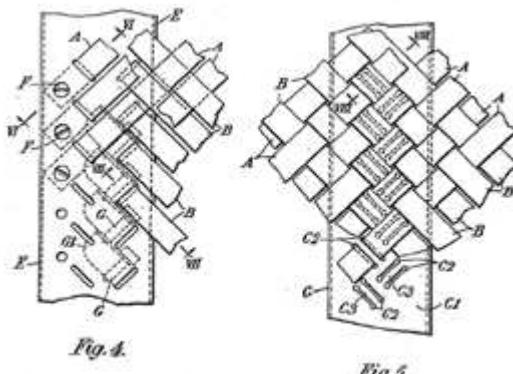


ABOVE A previously unpublished original Vickers three-view illustration of the Warwick Continental, which, unsurprisingly, bears more than a passing resemblance to the company's VC1, which became the Viking. The Warwick Continental was to have used Barnes Wallis's "Geosteel" method of woven metal covering, as seen RIGHT in Wallis's patent GB580574.

again the project had not been put out for tender — but that did not deter others from pitching ideas of their own.

#### VICKERS AND GEOSTEEL

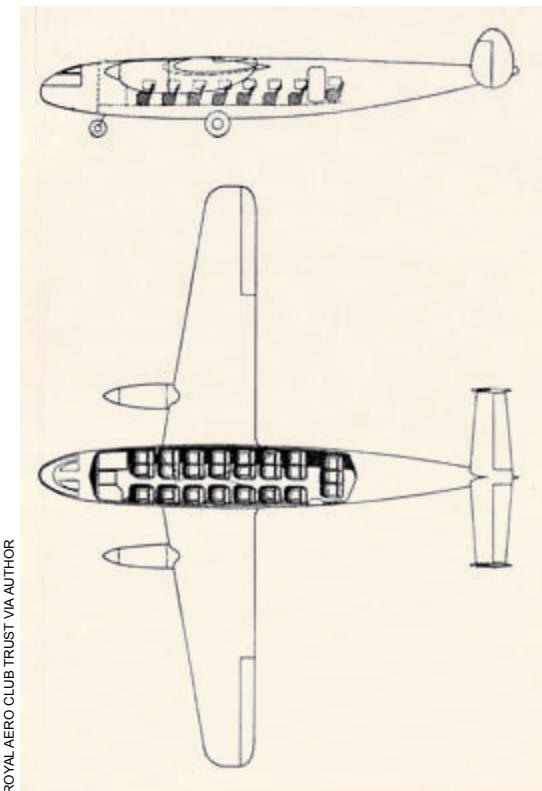
Vickers' views on future civil aircraft had not been submitted to Brabazon but the company had several designs in hand, including a 34-passenger project of comparable size and performance to the AS.57. In April 1944 a brochure was sent to the Brabazon Committee, unsolicited, for consideration. Known unofficially as the Warwick Continental, it was of geodetic construction throughout, incorporating the wings and tail surfaces of the Warwick bomber, Centaurus engines and a new fuselage of circular section. The covering of the fuselage was to be the untried "Geosteel" system patented by Barnes Wallis. Flight testing of the Warwick, and later the Windsor, had shown that standard fabric covering over a geodetic mesh frame performed badly at high speed, ballooning in a quilted pattern to the detriment of aerodynamic form. A special fabric incorporating steel-cable reinforcement was



undergoing trials to alleviate the problem, but Wallis now saw Geosteel as a better solution.

Ribbons of high-tensile stainless steel, approximately 2in (51mm) wide and 0.001in (0.025mm) thick, were interlaced in place on the airframe to form a continuous covering. Each ribbon was screwed directly to the geodetic structure or stringers at one end and put in tension by a form of in-built spool and ratchet at the other. The woven surface was then coated with a plastic sealing paint and rubbed down to a smooth finish.

To provide a pressure cabin within this geodetic frame fuselage, Wallis proposed installing an airtight membrane secured between fore and aft bulkheads and retained within an encircling mesh of flexible tension members to maintain the shape.



ROYAL AEROCLOUD TRUST VIA AUTHOR

**LEFT** A side elevation and plan view of the Miles M.56 24-seat high-wing airliner designed to replace the DC-3. The M.56 was to be powered by a pair of Rolls-Royce Merlin 24 engines with ducted low-drag radiators housed in the wing. A four-engined version was also proposed, but by the end of 1944 the MAP had shown no interest and the idea was shelved.

medium-range airliners that would soon bear fruit.

As Airspeed progressed with the design of the AS.57 the latter continued to grow until the standard accommodation had risen to 47, thereby leaving the original DC-3 replacement type unaddressed. One of the first proposals to fit this niche came from Miles Aircraft Ltd.

### MILES AHEAD?

Formerly Philips & Powis Aircraft, Miles had long championed “blended wing” designs for civil and transport aircraft, in which the fuselage was elongated laterally to blend into a thickened wing within which the engines were buried. A succession of such projects had been suggested from 1938 through to 1943, all of which failed to attract much interest. Miles then turned to smaller aircraft of more conventional style, of which one was the M.56 with 24 seats and a range of 1,600 miles (2,570km). Two- and four-engined versions were suggested, with twin Rolls-Royce Merlins as the company’s preferred choice, and a brochure was submitted to the Committee. A neat, well-proportioned design, it may well have won approval had Miles not been allocated the Brabazon Type VA contract for the development of the similar but smaller M.60 Marathon.

BOAC had voiced concern about the latest increase in size of the AS.57 and delays in its development. Hence, in order to deliver a quick low-risk DC-3 replacement, Vickers was awarded a contract in mid-1944 for the VC1, a civil derivative of its Wellington bomber developed in the same way as the Warwick Continental project, but with a conventional metal stressed-skin fuselage and metal-covered wings (after an initial batch with fabric-covered wings). The firm priced the aircraft aggressively to shut out competition and so regain a foothold in the airliner business.

His geodetic system had thus come full-circle, the membrane and tension members following the same principle he had first developed for the gas bag containment in the R100 airship.

The whole fuselage structure was diabolically complicated and it is no surprise that Vickers was developing wings and fuselages of more conventional stressed-skin structure in parallel, these being more acceptable both to the AM and BOAC. Civil aircraft, in general, were expected to have a longer service life than their military counterparts and ease of maintenance was a priority, a requirement that was not likely to be met by Wallis’s complex geodetic structures. Although this project was not approved, Vickers continued conceptual development of

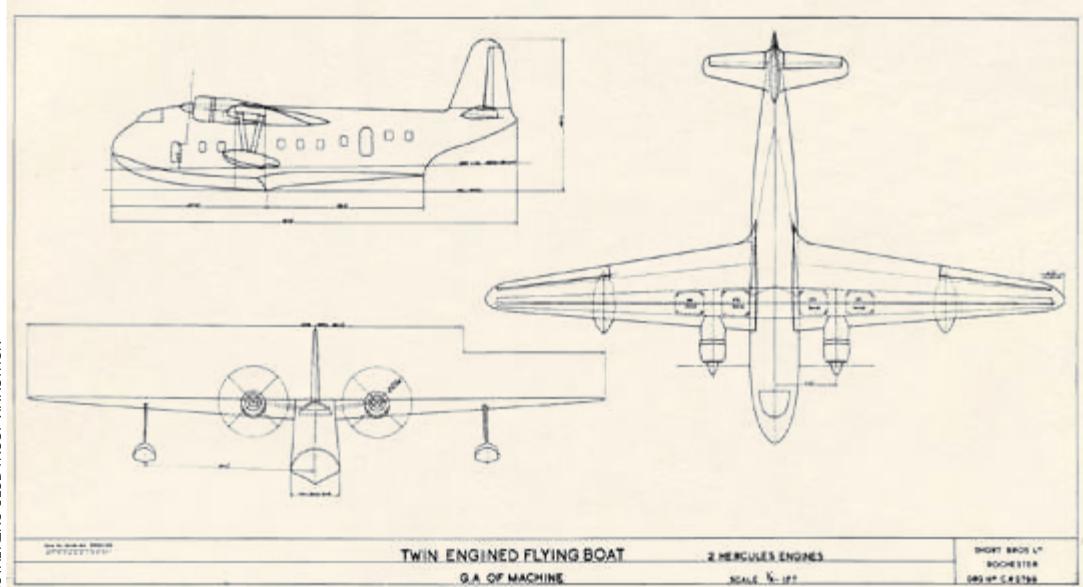
**BELOW** Vickers ultimately sidestepped the Geosteel concept intended for the Warwick Continental and opted instead for the much more conventional VC1, which became the Viking, as seen here. It was initially fitted with fabric-clad wings and tail, but later production aircraft had metal wings and empennages. Some 168 were built.

TAH ARCHIVE



' IN FEBRUARY 1945 SHORT SUBMITTED A BROCHURE FOR A FLYING-BOAT POWERED BY TWO BRISTOL HERCULES AND CARRYING 20 PASSENGERS OVER 1,000 MILES. BOAC SHOWED NO INTEREST ... '

ROYAL AERO CLUB TRUST VIA AUTHOR



ABOVE Essentially a development of Short Bros' tried-and-trusted pre-war Empire flying-boats, the company's "Short-Medium Range Civil Flying Boat" was presented in a brochure in February 1945, to be fitted with a pair of Bristol Hercules engines. It was already becoming increasingly clear, however, that the flying-boat era was over.

Neither Brabazon nor BOAC had indicated a requirement for a new flying-boat post-war, but it was known that both Blackburn and Saunders-Roe were lobbying hard for the Committee to sanction the construction of a very large trans-ocean machine. The Short S.38 Shetland, a large flying-boat designed for marine reconnaissance, was also offered for civil conversion, but BOAC was unimpressed by the economics. Short Bros, however, believed there was still potential for a short- to medium-range machine; in effect a replacement for the pre-war Empire-class boats. In February 1945 Short submitted a brochure for such an aircraft powered by two Bristol Hercules and carrying 20 passengers over 1,000 miles (1,600km) at 217 m.p.h. (350km/h) — it was essentially a flying-boat counterpart to Brabazon Type II. BOAC showed no interest.

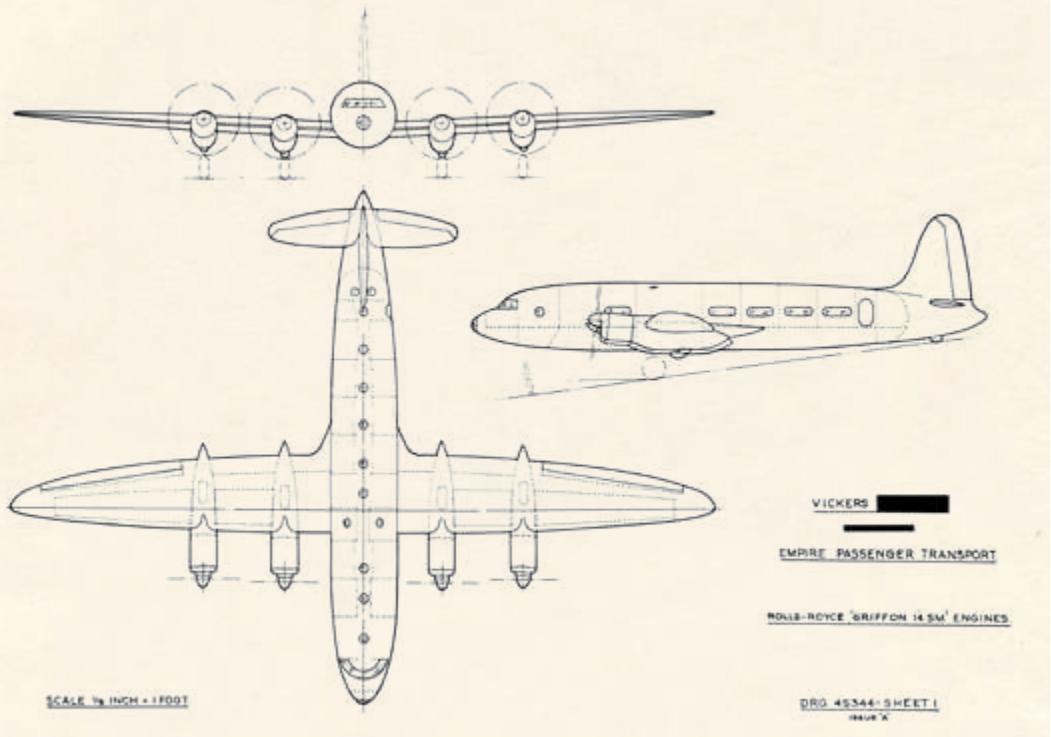
#### A YORK REPLACEMENT

Brabazon Type III was described as an "Avro York replacement", the latter being a transport aircraft utilising the flying surfaces of the company's Lancaster bomber mated to a new square-section fuselage. This could carry 20 passengers on routes up to 2,700 miles (4,300km) or a maximum of 56 over shorter distances. First flown in 1942, it was in limited production as a key part of Britain's immediate post-war transport needs. BOAC had factored this into its five-year plan but envisaged

its preferred replacement, Type B, as a somewhat larger aircraft than as defined for Type III.

In June 1943 it was announced that Avro had been selected as one of the companies authorised to commence design of new airliners, although, as with Vickers, its views on airliner development had not been submitted to the Brabazon Committee. It appears that Avro had already considered a transport derivative of the Lancaster IV (Lincoln) bomber, then under development, and a pressurised civil version was suggested as an interim for Type III while the company worked on a more advanced design. By October 1943 the Committee had decided to split Type III in two; IIIA for the transatlantic route with intermediate stops and IIIB for medium range. Consequently, Avro's conversion was proposed in two forms; the XX with a small slim fuselage for IIIA, and the XXI, with a more capacious wider, longer fuselage for IIIB. As interim designs they were deemed capable of quick development and endorsed by the government, which saw the XX as the best solution to enable the provision of a transatlantic service before the arrival of the Bristol Brabazon.

Detailed brochures were submitted in the first days of 1944; the XX became the Tudor I and XXI the Tudor II. However, although an advance on the York, they would offer no improvement over the Douglas DC-4 and Lockheed Constellation, both already in service, and neither quite met



ABOVE Taking the company's experimental Windsor bomber for inspiration, Vickers submitted an unsolicited design for the Brabazon Committee's Type III category for "Empire trunk routes", designated the Windsor Empire, as per this previously unpublished three-view. Note the Windsor bomber's distinctive elliptical wing planform.

BOAC's requirements for Type B or C, but were approved by the airline as acceptable until Avro's more advanced Type III aircraft became available.

#### THE EMPIRE CONTENDERS

Two other companies also submitted designs to Type III in early 1944, both unsolicited. The third of Vickers' bomber-derived airliners was the Empire Passenger Transport, or Windsor Empire, another fully geodetic design incorporating Geosteel, which could carry up to 40 day or 20 night passengers and had a maximum still-air range of 2,040 miles (3,280km). Unlike the Merlin-powered Windsor bomber, for which a production contract had just been issued, it was to be powered by four Rolls-Royce Griffons. The design was rejected for the same reasons as the Warwick Continental.

Short's "Long Stage Empire Landplane" was a scaled-down version of its Transatlantic Express, a project that had been a speculative tender to Brabazon Type I. It was to be powered by four Centaurus engines and could seat up to 40 passengers, or 20 for night flights. As Short stated in its brochure, "the programme of development for new British transport types so far announced has included one very large type for North Atlantic direct services, and several types of the 60,000–70,000lb [27,000–32,000kg] class suitable for medium-stage Empire service. The former is too large (and too far ahead) to meet the needs of long-

stage Empire services in the early years after the war, while the latter are not large enough". This was a summary that mirrored closely the view of BOAC and may well have gained the latter's approval. Unfortunately, Short Bros had fallen foul of the MAP, which rated the manufacturer's production as inefficient and its management as uncooperative. Consequently, in mid-1943, the government purchased the entire share issue of the company; the board resigned and Arthur Gouge, its chief designer, quit. The company was most unlikely to be allocated a new civil project, however attractive, at this juncture.

By mid-1944 it was becoming increasingly apparent that the original Brabazon definitions were no longer adequate. A review of the Type specifications against current and planned aircraft developments in the USA showed that the Brabazon Types were broadly comparable but lagging some three to five years behind. BOAC's growing concerns and more structured input from aircraft and engine manufacturers shifted development in new directions. The critical issue of manpower, especially for skilled draughtsmen, was not reviewed until the second half of 1944, and the MAP's timetable estimates for the projects were far from encouraging and continued to shift. In effect, a year had been wasted and the government had made poor decisions.

BOAC had never exhibited much enthusiasm

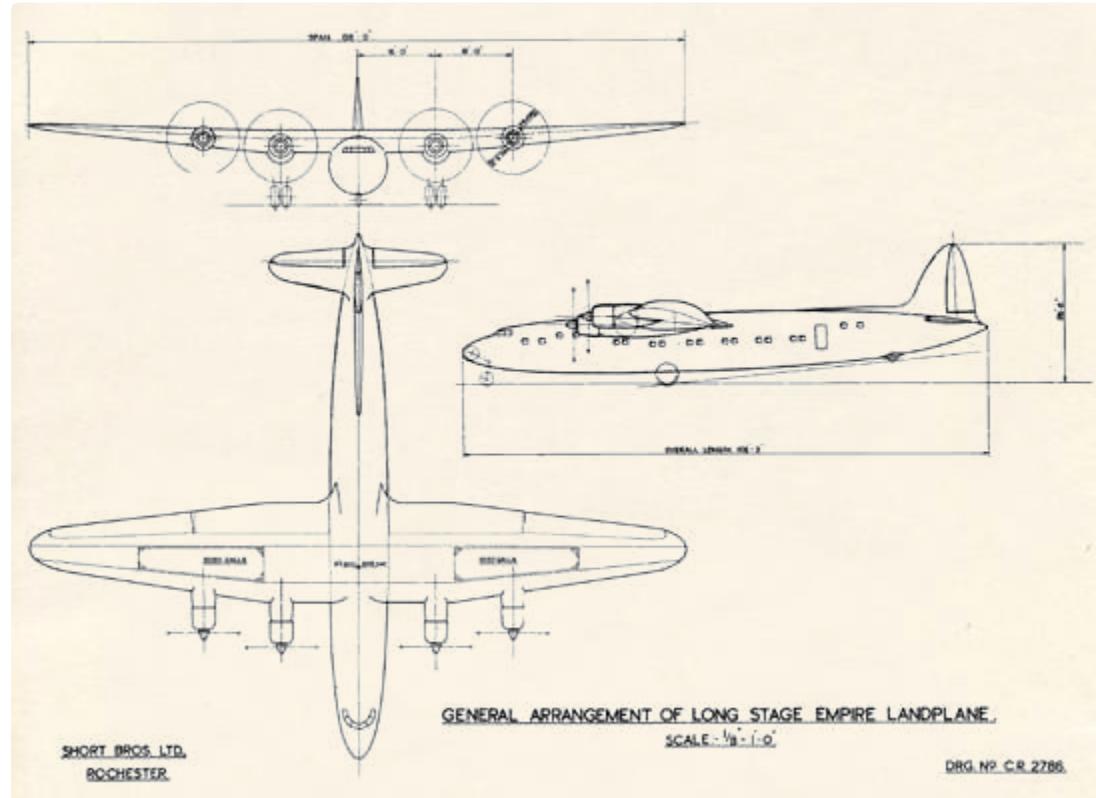
# COMMERCIAL AIRCRAFT OPERATED BY BOAC, 1939-45



	September 1939	December 1943	May 1945
<b>British</b>			
Armstrong Whitworth Ensign	12	9	9
Armstrong Whitworth Atalanta	3	—	—
Avro Anson	—	—	1
Avro Lancaster/Lancastrian	—	—	4
Avro York	—	—	5
de Havilland Albatross	7	—	—
de Havilland Flamingo	—	5	—
de Havilland Mosquito	—	5	4
Handley Page H.P.42/45	7	—	—
Short L.17	2	—	—
Short G-Class	—	1	1
Short C-Class	31	14	10
Short Sunderland	—	11	24
Vickers Warwick	—	—	1
<b>American</b>			
Boeing 314A	—	3	3
Consolidated Catalina	—	1	1
Consolidated Liberator	—	9	12
Douglas C-47 Dakota	—	20	57
Lockheed Electra	6	2	—
Lockheed Super Electra	7	1	—
Lockheed Hudson	—	2	3
Lockheed Lodestar	—	25	18

## POST-WAR CIVIL AIRCRAFT PROJECT SPECIFICATIONS

	Vickers Warwick Continental	Vickers Windsor Empire	Miles M.56	Avro XX	Avro XXI	Short LSE
<b>Powerplant</b>	2 x Bristol Centaurus	4 x Rolls-Royce (RR) Griffon	2 x RR Merlin	4 x RR Merlin	4 x RR Merlin	4 x Bristol Centaurus
<b>Dimensions</b>						
Span	102ft 0in (31.09m)	122ft 7in (37.36m)	80ft 0in (24.38m)	120ft 0in (36.58m)	120ft 0in (36.58m)	136ft 0in (41.45m)
Length	69ft 6in (21.18m)	88ft 7in (27.0m)	66ft 0in (20.12m)	74ft 0in (22.56m)	95ft 0in (28.96m)	108ft 3in (32.99m)
Wing area	1,091ft <sup>2</sup> (101.4m <sup>2</sup> )	1,321ft <sup>2</sup> (122.7m <sup>2</sup> )	800ft <sup>2</sup> (74.32m <sup>2</sup> )	1,421ft <sup>2</sup> (132m <sup>2</sup> )	1,421ft <sup>2</sup> (132m <sup>2</sup> )	2,140ft <sup>2</sup> (198.8m <sup>2</sup> )
Wing loading	40.6lb/ft <sup>2</sup> (198.2kg/m <sup>2</sup> )	54.5lb/ft <sup>2</sup> (266kg/m <sup>2</sup> )	32lb/ft <sup>2</sup> (156.2kg/m <sup>2</sup> )	49lb/ft <sup>2</sup> (239.2kg/m <sup>2</sup> )	49lb/ft <sup>2</sup> (239.2kg/m <sup>2</sup> )	51lb/ft <sup>2</sup> (249kg/m <sup>2</sup> )
Passengers	34	20-40	24	12-24	12-68	20-40
<b>Weights</b>						
Loaded	44,310lb (20,100kg)	72,000lb (32,600kg)	25,600lb (11,600kg)	70,000lb (31,700kg)	70,000lb (31,700kg)	108,500lb (49,200kg)
Total payload	6,090lb (2,760kg)	13,000lb (5,900kg)	—	8,090lb (3,670kg)	15,640lb (7,090kg)	11,000lb (5,000kg)
Fuel	1,010lb (460kg)	2,040lb (920kg)	—	3,000lb (1,400kg)	2,525lb (1,145kg)	4,040lb (1,830kg)
<b>Performance</b>						
Cruising speed	225 m.p.h. (362km/h)	248 m.p.h. (399km/h)	200 m.p.h. (321km/h)	280 m.p.h. (450km/h)	270 m.p.h. (434km/h)	230 m.p.h. (370km/h)
Still-air range	1,600 miles (2,570km)	2,200 miles (3,540km)	1,600 miles (2,570km)	4,320 miles (6,950km)	3,350 miles (5,390km)	2,350 miles (3,780km)



**ABOVE** Another previously unpublished three-view from the Royal Aero Club Trust archive, this original Short Bros illustration shows the company's proposed Brabazon Type III "Long Stage Empire Landplane", a smaller 40-passenger version of the "Transatlantic Express" it had submitted to fulfil the Brabazon Type I specification.

for the Bristol Brabazon, which it considered to be both too large and tailored too tightly to the Atlantic route, but it was presented with no option other than to accept Bristol's views. Interest waned further after BOAC backed development of Bristol's medium/long-range Britannia project in 1947; this was an aircraft that held the potential to fulfil both BOAC's trans-atlantic and long-range Empire requirements. The Brabazon was cancelled in 1953 before the second prototype was complete.

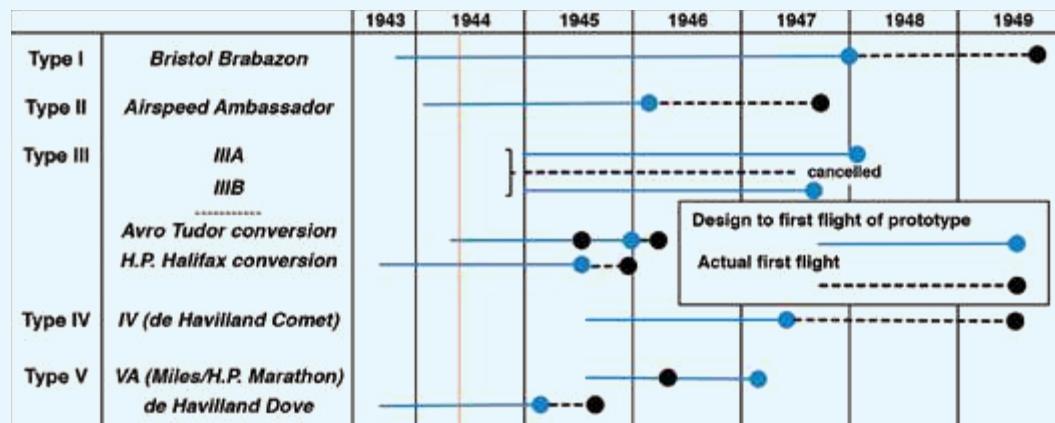
## FURTHER DEVELOPMENTS

The rather unexpected speed of post-war advances in jet and propeller-turbine technology opened up a wealth of possibilities. Vickers championed the latter, leading to the development of the VC2 Viceroy, a project that found great favour with the European division of BOAC. As a result, the Brabazon Type II was split into IIA — Airspeed's AS.57 — and IIB (the VC2) in early 1945. Design work on the Ambassador, as the AS.57 was named, which could have served well as an interim aircraft, was somewhat slow and approval to proceed granted unreasonably late; consequently, it was rapidly eclipsed by the far more capable VC2, which would enjoy great success as the Viscount.

BOAC's dissatisfaction with Types IIIA and IIIB led to the latter being recombined in late 1944 and temporarily put on hold so that the requirement could be reviewed. The interim Avro Tudors then ran into serious stability and drag problems that degraded their performance and slowed development. Nevertheless, the government issued small production contracts for both, but neither aircraft was accepted by the airline, a move that prompted a row with Avro and resulted in a formal government review.

Avro and BOAC were both criticised, but poor government overview also contributed to the problem. New specifications were drawn up in the immediate post-war years for medium/long-range airliners with higher performance, especially after the adoption of turboprops, but it would not be until the late 1950s that BOAC received suitable British aircraft.

Supported by the Tailless Aircraft Advisory Committee, the MAP awarded a contract to Armstrong Whitworth for the AW.52 flying-wing, an extremely ambitious experimental jet-powered mailplane. The need for such an aircraft was now considered as somewhat redundant, however, and Type IV was redefined as a passenger carrier. Accordingly, de Havilland pushed ahead with the design of a medium-range jetliner, the



COMPILED BY RALPH PEGRAM

D.H.106 Comet, with the enthusiastic support of the government and BOAC. The Comet held the potential to be a game-changer for the airline — but it was to be a hope sadly dashed by the disasters of 1953–54.

### THE BLAME GAME

There is little doubt that BOAC failed to engage effectively with the First Brabazon Committee, for which both parties should share the blame. Why BOAC then chose to develop its own aircraft specifications in apparent isolation is hard to fathom, as is the government's decision to proceed with the allocation of projects to selected firms without offering them out to tender, counter to the Committee's advice and before the views of BOAC and other potential customers had been sought.

It will also remain an unanswerable question as to whether more resources could have been assigned to civil projects in order to shorten development times and, perhaps, deliver better products. The impact that this may have had on military production is impossible to assess.

**BELOW** Although the deliberations and actions undertaken by the Brabazon Committee — and, importantly, the government — are often regarded as representing a loss of precious time and initiative, there was an undoubtedly success in Vickers' development of the Viscount turboprop, the prototype of which, G-AHRF, is seen here in 1948.

### KEY REFERENCES

IN ADDITION TO numerous contemporary government papers and articles in the aviation press, reference has been made to the following sources:

Airspeed Ambassador Brochure, 1948  
 Avro XX brochure, December 1943/January 1944, Royal Aero Club (RAeC) Trust Collection  
 Avro XXI brochure, December 1943/January 1944, RAeC Trust Collection  
 Transport Aircraft Committee 1942–43. Brabazon Archive, RAF Museum Hendon  
 Papers of Maj R. Mayo, BOAC Development Committee 1943, RAeC Trust Collection  
 Short Bros Proposed Long Stage Empire Landplane brochure, May 1944, RAeC Trust Collection  
 Short Bros Short–Medium Range Civil Flying Boat brochure, February 1945, RAeC Trust Collection  
 Vickers Large Twin Engined Civil Transport brochure, April 1944, RAeC Trust Collection  
 Vickers Four Engined Empire Passenger Transport brochure, May 1944, RAeC Trust Collection

In August 1946 BOAC's European division was split from its parent and launched as British European Airways (BEA), an effective reversal of the merger of 1939.



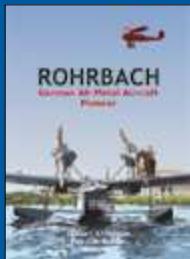
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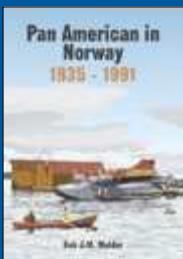
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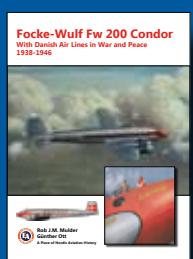
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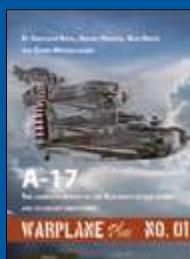
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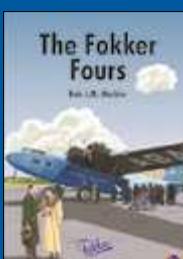
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**MAJOR SU SAMPONG:**

# ON THE WINGS OF THE HANSA



## Flying with the Cambodian air arm, 1960-75 / Part 2

**ALBERT GRANDOLINI** continues his three-part series on the flying career of the late Major Su Sampong, who served with the nation's air arm during its most turbulent period, with the Major's return to MiG-17F and Fouga Magister ground-attack operations in the wake of North Vietnam's military offensive into north-eastern Cambodia in late March 1970

**T**O PROTECT THEIR logistics network, the North Vietnamese immediately went on the offensive against the small Cambodian Army of 35,000 soldiers. Headed by General Lon Nol, who had led the coup against Prince Sihanouk in March 1970, the new Cambodian government sought military help from the USA, but initially received only some battalions of *Khmer Krom*, ethnic South Vietnamese Cambodians trained by the USA's Special Forces. Fairchild C-119Gs of the Republic of Vietnam Air Force (RVNAF) delivered weapons and ammunition, while the South Vietnamese also deployed to Pochentong Air Base a detachment of Bell UH-1H helicopters and Cessna O-1 light aircraft, which operated without national markings.

It was not until April 29 that year that both the Americans and the South Vietnamese launched a concerted offensive across the Cambodian border, targeting the North Vietnamese logistics depots. The operation created a political uproar in the USA, forcing the Nixon administration to

curtail it prematurely and strictly limit any aid to Cambodia. The latter was supervised by the Military Equipment Delivery Team, Cambodia (MEDTC), created in January 1971, comprising 113 members who were prohibited from fighting in Cambodia or even giving advice.

In the meantime, the French government closed its Military Advisory Mission to Cambodia under the command of Gen Viel, although two French flying instructors, Captains Rama and Lemoine, stayed several more weeks. Moscow and Peking also suspended all military aid.

### BACK TO JETS

As were all pilots of the newly named *Aviation Nationale Khmère* (AVNK), Su Sampong was fully mobilised to help Cambodia's hard-pressed army units, flying up to three missions a day. During these early weeks of the conflict, he mainly flew MiG-17Fs and Fouga Magisters. He recalled:

"We mainly flew strafing missions, owing to the limited range of the MiG-17F without external fuel tanks; its two 23mm and one 37mm cannon



**OPPOSITE PAGE, TOP** Used in the ground-attack role by the Cambodians, the Fouga CM.170 Magister was fitted to carry M-26 anti-personnel cluster bombs on underwing hardpoints. Serial 306 is seen here with a pair of M-26 units under the port wing, in the standard colours the type wore in October 1970. Artwork by TOM COOPER © 2021

**OPPOSITE PAGE, LOWER** The AVNK's pilot's wings incorporated the Hansa, the mythical bird on which Brahma goes to war in Hindu mythology. VIA AUTHOR

**LEFT** A group of MiG-17F pilots of the AVNK's Intervention Group discuss their next sortie against the North Vietnamese. From left to right: Capts Nhek Poon, Prak Ban and So Potra. DARASY VAR COLLECTION

place the cine-camera hump above the air intake just on the lower fringe of the targeted area, aim with the gunsight, drop the bombs and pull up at 800m (2,600ft).

"After a few weeks we had depleted our stocks of Russian bombs. The commander of the *Groupe d'Intervention* [GI — Intervention Group] then decided that we should continue the bombing missions with recently furnished American 500lb [225kg] Mk 82 bombs. The problem was that their attachment points differed from those of the Russian bombs. So, it was decided that we could fix them only at the forward attachment points, with the rear of the bomb hanging downward. You had to be careful on take-off not to pull back too much on the stick and run the risk of dragging the bomb's tailfins on the runway — with catastrophic results. But we all had a 'gung ho' attitude, so we proceeded that way. A team of USAF armourers came in and helped us harmonise the gunsights with the ballistics of the Mk 82. One day, during take-off, one of my bombs worked loose and fell off, exploding on the parade ground of an NCO School. Fortunately there was nobody there.

"The cessation of the delivery of spare parts by the Soviets began to have an adverse effect on the serviceability of our MiG-17s. Our technicians modified the fuel-injection system to be compatible with the American JP-4 fuel we now had available. When the cannon began to wear out on three of our MiGs we replaced them with two 0.50in machine-guns. To maintain the centre of gravity we bolted an 80kg [176lb] concrete weight in the gun chassis.

"Naturally, the Americans were very keen

could inflict heavy damage. I remember one day being despatched at the last minute on a hunt along Route 1 for a single white Citroën 2CV car. Reportedly, it was carrying a Khmer Rouge group that had just set up a terrorist bomb attack. I found a sole vehicle driving along a deserted stretch of road, and it turned out to be the Citroën. I placed a single 37mm round just atop the engine compartment, blowing up the whole vehicle.

"We also attacked targets with two Soviet-built 250kg bombs. But in this configuration, with the bombs installed instead of external wing tanks, the range was limited to around 45min of flying. Usually, that meant 20min to reach the target, 5min loitering above the area to pinpoint it, then 20min to return to base, all while constantly surveying the fuel level. The procedure was to dive from 2,000m [6,600ft] at a 35° to 45° angle,

**BELLOW** In the weeks following Cambodia's change of government and the North Vietnamese offensive, a red lightning bolt was painted on the fuselage of the air arm's MiG-17Fs, inspired by similar markings applied to the Dassault Mystère IVAs of France's Armée de l'Air, on which most of the Cambodian fighter pilots had trained.

AUTHOR'S COLLECTION





ABOVE Several Cambodian MiG-17Fs were loaned to the USAF for thorough evaluation as part of the American Have Privilege project. This example, serial 1024, was flown by USAF Capts Wendell Shawler and William Gilbert at Phù Cát in southern Vietnam, in dissimilar combat trials against various contemporary American fighters.

to evaluate our MiG-17Fs and several were despatched to South Vietnam for that purpose. Myself, I went for a presentation at Tan Son Nhut and Biên Hòa airbases near Saigon, attracting a lot of interest from USAF and RVNAF pilots. I also flew a lot of missions in the Magister, operating as part of a light strike squadron alongside our [Cessna] T-37Cs. We usually carried light CBUs [cluster bomb units] or 50kg [110lb] fragmentation bombs to use in addition to strafing with the twin 7.5mm machine-guns in the nose. One day, after completing a bombing pass, I joined up with a USAF [Fairchild] AC-119 also operating in the area. Its American crew seemed surprised to see a French-built aircraft flying alongside. I vividly recall one of them taking pictures."

## THE RUSTICS

Most of the air support assets used to stabilise the situation in Cambodia at this time was furnished by the USAF and RVNAF, but by the end of 1970 more than half of Cambodia had been occupied

by the North Vietnamese, who raised new Khmer Rouge units. As few Cambodian Army officers spoke English, the USAF posted French-speaking observers to its Forward Air Control (FAC) units, in order to co-ordinate with the Cambodian forces. However, the source quickly dried up and it was decided to post Cambodian officers to the FAC units as part of the *Rustic* project, which operated from June 19, 1970, until August 15, 1973, serving initially from Tan Son Nhut, then Biên Hòa (until October 1971), before moving to Ubon in Thailand. The project was so secret that it was placed directly under the supervision of the Military Office of the White House in the USA.

Initially, Cambodian Army officers were detached to *Rustic* but their lack of experience in air operational procedures hampered the programme. By early 1971, while the Americans were helping to establish a Tactical Air Co-ordination Center (TACC) at Pochentong under the guidance of the USA's Air Attaché in Phnom Penh, Lt-Col Mark Berent, it was decided to post

**MiG-17F serial 8022 of the Khmer Air Force (KAF), with distinctive red lightning bolt along the fuselage. Once its supply of Soviet-built bombs had been exhausted, the KAF armed its MiG-17Fs with American 500lb Mk 82 general-purpose bombs, attached only to the forward attachment point of the wing's pylons, as seen here.**  
Artwork by TOM COOPER © 2021





ABOVE The North American OV-10 Bronco was first deployed to Vietnam by the USAF in 1968, the type proving an invaluable asset for the air arm's Forward Air Controllers (FACs). Su Sampong joined the "Rustics" after the unit's move to Biên Hòa from Tan Son Nhut in late June 1970, flying frequent FAC missions in the highly agile Bronco.

Cambodian pilots to *Rustic*; around ten a month on a rotational basis.

Su Sampong took his turn, as he recalled:

"I was initially sent to the Forward Air Controller School at Da Nang, colloquially known as FAC University — or FAC-U! There I was introduced to the use of the grid-card co-ordinates system to plot targets, as well as the procedures for ground-attack aircraft and the most appropriate types of ammunition for specific targets. The training session concluded with an escape-and-survival exercise, including a simulated rough interrogation as a prisoner and retrieval from the jungle by helicopter. This was very useful training for us, considering that the Khmer Rouge never spared a Cambodian pilot that fell into their hands.

"I finally joined the *Rustic* programme at Biên Hòa, where the unit was flying North American OV-10A Broncos and Cessna O-2As, the latter mostly for night missions. Even in the back seat of the Bronco I was impressed by its performance as a COIN [counter-insurgency] aircraft and secretly dreamed that we should have it in our inventory. Our missions started at dawn after a hearty breakfast and a long and detailed briefing. We usually took off around 0700hr for a 3hr mission. Some missions with a 230 US gal ventral fuel tank lasted more than 6hr.

"We would orbit a working area and then guide flights of fighter-bombers on to different targets marked with white phosphorous rockets. There were usually F-4s, which were not always very precise in their bombings. There were also some F-100s. I once guided a flight of F-105Ds against

a bridge. They came from Thailand, short on fuel, made a single pass and all their bombs missed the target. The bridge was finally taken out by a RVNAF Skyraider flight. American Bronco pilots often let me take the controls, and I particularly appreciated the agility of the OV-10; you could roll extremely precisely with the help of the spoilers. The Americans were pleased to have us with them to communicate with our ground troops. They told me that they had once had an officer who purported to speak French, from Louisiana. But he spoke with such a heavy Cajun accent that none of our officers could comprehend him.

"Living in the same quarters with the *Rustics*, attending the same mess and flying long flight hours together created a real bond between us despite our cultural differences. We tried to have fixed teams of Cambodian and American flyers to improve co-operation. I mostly flew with Capts Jim Siebold and Dave Van Dyke. I also flew some sorties with a Hawaiian pilot who handed me control during the return journeys so he could play his ukulele and sing! The rigorous and methodical running of the operations of a USAF unit deeply impressed me, even when compared to a French air base, and inspired us Cambodians about how to organise ourselves.

"I was sometimes posted to the RVNAF's 817th Attack Squadron, flying AC-47Ds, to play the same FAC role, helping them to co-ordinate with our ground units. Formed at the American school, the RVNAF also displayed a great professionalism. I was very surprised that all their briefings were completed in Vietnamese. In Cambodia the aeronautical language was French,



**ABOVE** By June 1970 Nixon could no longer keep American troops in Cambodia without the support of Congress, which was not forthcoming. The top-secret Rustic project was born, using USAF and Cambodian aircrew, including, from left to right, Lt Kiet Kim Huot, Capt Om Koon; Capt Claude Newland, Capt Ma Kim Oeun and Lt Ly Sopham.



**LEFT** During the night of January 21, 1971, some 97 North Vietnamese commandos of the 367th Assault Sapper Group, which specialised in air base attacks, infiltrated Pochentong and destroyed nearly 60 per cent of the KAF's air assets, including this T-28D.

**BELLOW** Another of the T-28Ds destroyed during the attack on Pochentong. Although the KAF inventory was hit hard by the North Vietnamese attack, the human resources – air- and groundcrew, which were much harder to replace (and took longer) – remained relatively unscathed.





ABOVE A Khmer Air Force T-28D during a check flight after overhaul at the Thai-Am maintenance facility in Thailand. Note the absence of the underwing machine-gun gondolas, which have not yet been refitted, and the "stars and bars" type of insignia, incorporating the Cambodian towers symbol, used by the KAF during 1970-75.

so we were unable to translate into Khmer the technical terms. So I communicated with the Vietnamese in French. After a night combat mission, we usually made a stop at Pochentong and went to Phnom Penh's central market for a well-deserved Chinese noodle soup for breakfast. They also bought fruit for their relatives; they were far cheaper in Cambodia than in Saigon."

### CATASTROPHE AT POCHENTONG

On the night of January 21, 1971, a North Vietnamese sapper team infiltrated Pochentong and launched a devastating attack. With the exception of six North American T-28Ds deployed at Battambang and the training aircraft of the Air Academy which had been relocated there, a large part of the AVNK inventory at Phnom Penh was destroyed or damaged in this single stroke. More than 60 per cent of the air arm's aircraft were destroyed in the attack, the most successful raid the North Vietnamese ever undertook against allied airbases during the conflict. All the ground-attack jet aircraft and T-28s based at Pochentong were written off. Fortunately, the enemy commandos did not hit the living quarters. Su Sampong took shelter in a nearby drainage canal with some of his other pilot colleagues. The base was closed for a week while repairs were undertaken.

To bolster the morale of the inhabitants of the capital, the AVNK's surviving T-28Ds and armed Morane-Saulnier Alcyons from Battambang performed low-level flights over Phnom Penh.

Operations resumed as soon as replacement aircraft had arrived. This considerable setback forced the Cambodians to reorganise, resulting in the creation of the Khmer Air Force (KAF), a service now completely independent of the Army, on June 8, 1971. Its commander, Colonel So Satto, requested that the USA supply Northrop F-5As to replace the destroyed MiG-17Fs, but the American government offered only a minimal low-profile aid package, instead providing additional T-28Ds, the type becoming the standard Cambodian attack aircraft. More than 60 airframes had been delivered by early 1975, and were to re-equip three fighter squadrons.

The USA also supplied additional de Havilland Canada U-1 Otters, C-47/AC-47s, O-1s and UH-1Hs. Two new batches, each of 70 pilots, graduated from the Air Academy during a fast-tracked training programme to bolster the reconstituted units. Among the graduates was Su Sampong's cousin, Lt Su Cchom Doeurn, who was posted to a T-28 squadron. Su Sampong recalled:

"I was initially worried for him, knowing that he had escaped a potentially grave accident during his training in a Gardan GY-80. He was performing a series of touch-and-goes with his instructor when the engine failed and the propeller broke away. He managed to land straight ahead despite a layer of thick oil covering the windscreens. The story followed him, and he was thereafter forced to have a placard saying, 'in case of emergency, eject propeller' in the cockpit!"



**LEFT** Cambodian pilots at a review parade at Battambang. Note the placard sewn on to the back of their flying suits, written in Cambodian, Vietnamese and Chinese, explaining that they were protected by the Geneva Convention if taken prisoner. In the event, however, the Khmer Rouges routinely executed any enemy pilots they captured.

**BELOW** T-28D-5 O-53649 previously served with the US Navy before joining the KAF in late 1973, and is seen here with a pair of Mk 82 bombs on each wing. It was later damaged in an accident at Kampong Thom in June 1974 and escaped to Thailand in 1975. The badge, incorporating a stylised winged bomb, is the KAF Fighter Group's pilot insignia. Artwork by TOM COOPER © 2021

"He only flew the T-28 and became an excellent pilot, very aggressive, sometimes flying up to six missions a day, logging more than 1,000 combat missions by the end of the war. He was renowned for the precision of his attacks, foremost when releasing napalm tanks. He experienced another crash in 1973 when taking off from Battambang; with four napalm tanks under his wings his T-28D's engine failed. He jettisoned the tanks and made a belly landing in a rice field, ending up between two palm trees that tore the wings off. The rescue UH-1H sent to retrieve him found him on the pillion of a motorcycle he had haled, returning to the base."

Su Sampong and his by-now veteran colleagues had to bring the newly graduated pilots up to speed on operational matters, as he recalled:

"The most experienced pilots had now to take on charge the newly graduated cadets, who had only about 130 basic flight hours. They were immediately sent into combat after a quick conversion course and a few firing and bombing exercises on the range. In fact, most of the training took the form of "on-the job" training. We had

received a dozen T-28B/Cs from US Navy stocks, which helped transition to the T-28Ds. We lost at least a dozen of these youngsters in accidents owing to inexperience. The core of experienced pilots trained in France was now diluted among the newly raised units staffed with fast-tracked pilots. Nevertheless I think that, despite its shortcomings, the T-28D was a good choice; simple to maintain, sturdy and easy to fly. We had three versions in the inventory: the T-28D-5, with four wing pylons and two 0.50in machine-gun pods; T-28D-10, with bigger machine-gun pods which contained more ammunition and the T-28D-15, with six wing pylons and 0.50in machine-guns installed on streamlined gondolas bolted to the underside of the wings. [NB These were purely KAF designations — Ed.]

"Our usual warload comprised four 500lb Mk 82 bombs or four napalm tanks, or six rocket pods, each containing seven 70mm rockets. The Americans also gave us CBU-25 cluster-bombs. Towards the end of the war my cousin Doeurn also dropped some fuel/air thermobaric CBU-55s, a terrifying weapon that burned the surrounding





ALBERT GRANDOLINI COLLECTION

air and created an overpressure. Unlike the T-28Ds in service with the Laotians and the Thais, ours were not fitted with the Stanley YANKEE extraction system, a kind of light ejection-seat. That would have saved some of our pilots' lives."

### BORDER BATTLES

At this point Su Sampong was flying most of his missions in the T-28D. The efficiency of KAF operational procedures steadily improved and most of the close-air-support sorties were now controlled by FAC. In addition to providing airborne observers aboard Cessna O-1s, the KAF also trained ground FAC officers posted to the main Army units. Su Sampong recalled:

"I flew dozens of sorties in support of our troops. In October 1971 we were all mobilised for Operation *Chenla II*, the greatest offensive then launched by the FANK [Forces armées nationales khmères — Khmer National Armed Forces], with 20,000 troops mustered to reopen Route 6 between Kampong Cham and Kampong Thom. After some early progress, our units were counter-attacked by two North Vietnamese divisions and forced to retreat in disarray. We were ordered to bomb our abandoned vehicles. The enemy also shot down six of our T-28Ds. While replacement aircraft arrived, we began to maintain permanent detachments of six T-28Ds at Battambang and Ream [at Sihanoukville]. These formed the nucleus of newly raised squadrons. We also operated occasionally from Kampong Thom, and some of our missions were attacks undertaken against enemy traffic on the upper Mekong River or its tributaries into Tonlé Sap Lake.

"In early 1972 the enemy launched a new offensive against the area of Vihear Sour, near Phnom Penh. For the first time regular Khmer

**ABOVE** A pair of KAF T-28Ds return to Pocheontong after a ground-attack mission on August 15, 1973. The date is significant as it was the day the USA halted all offensive operations over Cambodia by American air assets. From this point on, the pilots of the KAF would face the nation's enemies alone. Su Sampong's story concludes in the final part of the series in TAH35.

Rouge battalions were engaged as well as the North Vietnamese. They switched their attacks against the district of Kampong Trabaek with Russian tanks, two of which were destroyed by our T-28Ds and the rest by USAF F-4s. We began to be fired on by Soviet-built SAM-7 shoulder-fired missiles around Svay Rieng. We devised new tactics to counter this threat; we flew at a higher altitude during transit flights, criss-crossing our trajectories during our dives and pull-ups to check each other's tails. In the most dangerous areas we put up a search-and-rescue flight of two UH-1Hs and one AC-47D, ready to intervene to pick up any downed airman.

"With time and experience, the skill of our newly graduated pilots improved and they began to provide efficient close support for the Army. My cousin Doeurn was involved in a strike made by ten T-28Ds at the end of 1974 against an enemy logistics depot near Kratié. In fact, they caught a convoy of North Vietnamese trucks fully loaded with ammunition. Some 120 trucks were destroyed during this spectacular attack — the most successful ever undertaken by the allied air forces on the Ho Chi Minh Trail."



**NEXT TIME** In the concluding part of Albert Grandolini's three-part series, Maj Su Sampong recalls flying Cessna O-1s and Helio Stallion gunships with the Observation Group, Fairchild C-123K Providers for the Transport Group and his escape from war-torn Cambodia in 1975



# SPECIAL DELIVERY

## PAN AMERICAN'S 'AIRLIFT' FOR THE WORLD'S FAIR, JULY 1957

In July 1957 the first of a series of nine consignments of materials for the USA's pavilion at the following year's Expo 58 exhibition arrived aboard a Pan American World Airways Douglas DC-6A at Melsbroek Airport in Brussels. **NICK STROUD** provides the background to a sequence of photos taken on *Clipper Gladiator*'s arrival





**O**N AN UNSEASONABLY cold and blustery Thursday in mid-July 1957, Pan American World Airways (PAA) Douglas DC-6A N6258C, named *Clipper Gladiator*, rolled across the windswept, puddled taxiway at Brussels' Melsbroek Airport before coming to a halt and shutting down its four Pratt & Whitney Double Wasp engines on the apron beside Scandinavian Airline System DC-6 OY-KLU. Carried in the new arrival's capacious fuselage was the first of nine consignments, all delivered by PAA over the next eight days, for the building of the American pavilion for the World's Fair, to be held in Brussels during April–November the following year.

#### LEAVE IT TO ZIEGLER

On hand to transport the two-and-a-half tons of roofing materials from the DC-6A's two large port-side freight doors to the prospective site for the Fair — on the Heysel plateau north-west of the Belgian capital — were the pantechnicons of the official "forwarder" of the exhibition selected by the Belgian government, the local *Déménagements Internationaux Ziegler*.

Each PAA "Super 6" during the week-long "airlift", as contemporary news reports referred to the flights, carried more than 320 items across the Atlantic from the roof manufacturer's factory in Manchester, New Hampshire, via a stop in Boston.

**Douglas DC-6A N6258C (c/n 44258/467) Clipper Gladiator has both its port-side freight doors open after its arrival at Melsbroek on July 18, 1957, with roof panels being fed directly from the rear door into an impressive three-container Ziegler truck. Gladiator joined the PAA fleet in May 1954 and served with the airline until it was sold to the Portuguese Air Force in August 1961.**

ALL IMAGES TAH ARCHIVE





ABOVE Representing the USA's Commissioner General, Dan Schausten (holding box) accepts a gift from the PAA crew at Melsbroek on July 18, 1957. BELOW LEFT Ziegler crew manhandle roof panels from Clipper Gladiator's rear freight door. BELOW RIGHT Schausten and the DC-6A's captain (identity unknown) pose for photographs.





ABOVE The finished article — the main exhibition building of the American pavilion, for which the PAA DC-6As had supplied the roofing panels and other materials the previous July. Only a handful of the original buildings constructed for Expo 58 managed to escape demolition, notably the Atomium and parts of the American pavilion.

The first major exhibition to be organised by the *Bureau International des Expositions* after the Second World War, Expo 58 was intended to be a scientific showcase for the world's achievements, drawing together cutting-edge technology from all corners of the world, including behind the Iron Curtain, with a view to easing Cold War tensions and "inspiring a new devotion to human interests". Indeed, with the latter in mind, the USA and Soviet Union were allocated adjoining sites in the Foreign Section in the exhibition's Square of Nations.

#### THE AMERICAN WAY OF LIFE

While the Soviets focused on Sputnik and other technological advances, the Americans chose to showcase "the American way of life". Howard S. Cullman, the USA's Commissioner General for the event, explained that "we don't intend to use the 'hard sell'; we don't think we have to — not in selling America". The pavilion, designed by Edward Durrell Stone, comprised four separate buildings, three of which were rotundas and one consisting of railroad boxcars. Two of the rotundas contained theatres and the third, the largest, was designed to hold a display designed

by Peter G. Harnden and Bernard Rudofsky, who described it as "a pleasuredome rather than an exhibition hall". Neo-classical in its design, the pavilion was crowned with a translucent bicycle-wheel-like cable-tensioned roof, and it was the panels for these that were brought in by the PAA DC-6As. The American architectural press saw the pavilion as representing the nation's "democratic vitality and romance". Soviet newspaper *Pravda* called it a "gilded candy box". So much for easing tensions . . .

Following the delivery of the roofing panels, construction began on the American site, and was completed for the official opening of Expo 58 on April 17, 1958. More than 40 nations took part over the next six months, the exhibition closing its doors on October 19. Deemed a great success, Expo 58 was Belgium's last World Fair, although the main American pavilion was used by Belgian television and radio company NIR (now VRT) from 1961, one of the theatre rotundas being used as a television studio.

More than 60 years later, the materials flown across the Atlantic and delivered during a rainy week in July by the Clippers of PAA remain standing at Heysel.





# ARMCHAIR AVIATION

**We take a look at what's available for the aviation history enthusiast in the world of books and other literature, from hot-off-the-press publications to reissued classics**

## **The Secret Horsepower Race: Western Front Fighter Engine Development**

By Calum E. Douglas; Tempest Books (an imprint of Mortons Books), Media Centre, Mortons Way, Horncastle LN9 6JR; 11 1/4in x 8 3/4in (295mm x 220mm); hardback; 480 pages, illustrated; £35. ISBN 978-1-911658-50-4

MANY TAH READERS have a seemingly insatiable appetite for articles on engines — a subject which, like aerodynamics, is often relegated to the “too difficult” box by the mainstream magazines — but this delectable doorstop of a book is enough to satisfy the hungriest of such cravings.

While the usual arguments about fighter aircraft superiority during World War Two revolve around the airframes — Hurricane or Spitfire? Later-variant Messerschmitt Bf 109 or Focke-Wulf Fw 190? — they seldom go into any great detail about the powerplants. This volume, written by aerospace-welder turned mechanical-engineering-masters-graduate turned Formula-One-technology-transfer-vehicle-engine-specialist Calum Douglas, redresses the balance. It reveals the compelling history of the behind-the-scenes scramble for fighter engine performance during World War Two. Covering developments in Germany, Britain, the USA and Italy, it concentrates especially on the first of those countries — capitalising on the author’s command of the German language and contacts including the son of Daimler-Benz aero-engine designer Prof Dr-Ing Karl Kollmann, and the Messerschmitt Foundation’s chief engine mechanic, the late Sigi Knoll.

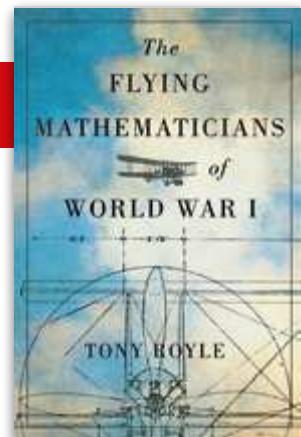
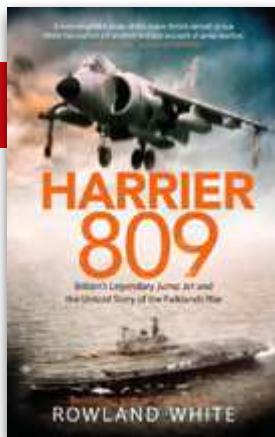
The story begins with the Schneider Trophy seaplane races, which did so much to accelerate engine and fuel development in the inter-war years up to 1931 (despite Germany being excluded from the contest under the terms of the Versailles Treaty). The lead-up to war then saw further developments, such as in direct fuel-injection, superchargers and cooling systems.

Divided into year-by-year chapters covering 1939 to 1945, the core of the book charts all the key developments, including the struggle for better engine performance during the Battle of Britain (and the unintended consequences thereof); airframe advances often outstripping engine improvements in the following year; major strides in (unglamorous but essential) bearing technology giving the UK and USA the edge from 1942; Germany’s use of the innovative swirl throttle (no, me neither), and the pros and cons of synthetic fuel.

Throughout the first half of the book, the chapters are peppered with welcome potted biographies of the engineers and pilots involved, emphasising that aviation history is not just about machinery, but people too. And throughout the entire volume, excellent use is made of photographs (both historic and modern), design drawings, diagrams and graphs to complement the detailed and lively text. The full-page, full-colour wartime schematic of the BMW 801 *Kommandogerät* engine management unit on page 158 is a sight to behold.

Even readers not habitually given to cooing over high-performance engines can hardly fail to be engaged and beguiled by the author’s description of them as seemingly living beings, inside which “a multitude of very different things must all happen at once, hundreds of times every second, in appalling and constant proximity to absolute failure”.

I feel a bit churlish criticising any aspect of this marvellous book, and really I have only two minor niggles. One is the extensive use of a “ribbon-needs-replacing” typewriter-style font for all quotes. It’s fine in moderation, adding to the secret-technical-report feel of the book, but readability suffers when you’re faced with page after page of it. The other, which is also a matter of visual presentation, is that where possible the line drawings and diagrams could have done with being reproduced at a higher resolution, the better to preserve the crispness of fine lines.



Other than those two points, I struggle to find any fault at all with this book, which I reckon any aviation publisher would be very proud indeed to have on its list. It is a *tour de force*; an absolute masterpiece.

**MICK OAKLEY**

### ***Harrier 809: Britain's Legendary Jump Jet and the Untold Story of the Falklands War***

By Rowland White; Bantam Press (Penguin Random House), 61–63 Uxbridge Road, London W5 5SA; 6½in x 9½in (165mm x 241mm); hardback; 481 pages, illustrated; £20. ISBN 978-1-787631-58-8

THERE HAVE BEEN many accounts of the well-known 1982 air war in the South Atlantic, but Rowland White has found a new angle by making the exploits of the third Sea Harrier squadron, No 809 Naval Air Squadron (NAS), rather than Nos 800 and 801, the main thread of the story. This is a thoroughly researched history book packed with fascinating detail, written in an urgent and very readable style. The book draws the reader into the action from the beginning, providing a vivid appreciation of the experiences of the pilots, radar operators and gun and missile crews of both sides, as well as the men of the British Merchant Navy.

Many of the airborne and maritime events described here are familiar, but rendered fresh and exciting in this new telling. It is the background stories that are revealing of the manner in which the war was won.

The coverage is comprehensive, including the assembly and formation of No 809 NAS from scratch in record time, the preparation of the Merchant Navy's ill-fated *SS Atlantic Conveyor*, on which the squadron travelled south from Ascension Island, UK training against French Dassault Mirages and the AIM-9L air-to-air missile saga. Also covered are fascinating lesser-

known aspects, including a plan to operate RAF Canberra PR.9s from Chilean bases and SAS raids on mainland South America and the Falklands. RAF Nimrod and Vulcan operations, Sea Harrier camouflage, Argentinian Navy and Air Force Super Etandard, Skyhawk, Pucará and helicopter operations are well covered, as are the involvement of British and Argentinian radars and missiles, the view from Washington DC, RAF Harrier involvement and, of course, the shooting war itself, the latter concentrating on the activities of the Navy's Sea Harrier FRS.1s and the RAF's Harrier GR.3s. The thinking of the commanders and the political background are also explained throughout and the characters of the main players emerge from the action.

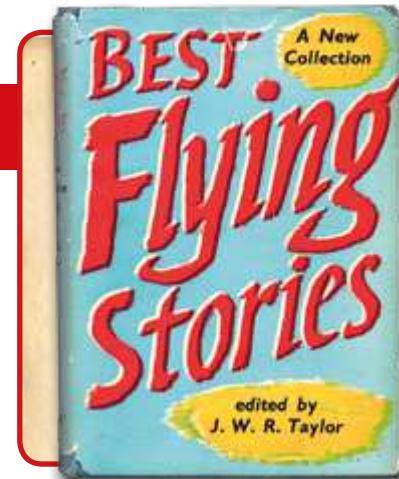
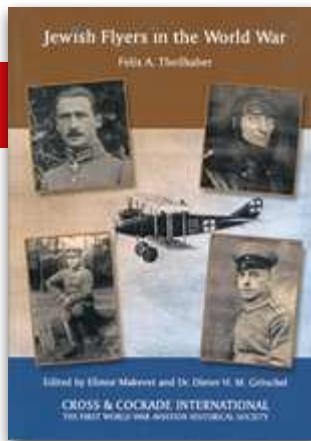
At some 480 pages this is a big book, with an excellent index, a useful 12-page glossary and an 11-page bibliography listing source material. It is illustrated with 24 pages of relevant photos, many published for the first time, plus eight pages of helpful maps and a Sea Harrier FRS.1 cutaway by Mike Badrocke. Unusually, I spotted no technical mistakes (although I would point out that weapons are not "bolted" to pylons but "loaded"; otherwise full marks). The author is to be congratulated on another informative and entertaining work of narrative history.

**CHRIS FARARA**

### ***The Flying Mathematicians of World War I***

By Tony Royle; McGill-Queen's University Press, Montreal, London and Chicago; 6½in x 9½in (159mm x 235mm); hardback; 284 pages, illustrated; £22.50. ISBN 978-0-228003-73-1

OVER THE LAST few decades cosy coteries of academics have adopted the practice of providing glowing promotional flyleaf endorsements for the books produced by their compatriots. Such is the case with this volume,



but unfortunately the content falls somewhat short of expectations.

Tony Royle, a former RAF and commercial airline pilot, sets out to provide an account of the mathematicians of the pioneer years and the First World War in Britain who were also pilots and used these combined skills to develop or improve aviation technology, sometimes at the cost of their lives. Unfortunately the book is marred by some glaring and rather naïve errors that make the reader wary of the whole content.

For example, the author avers that "reliable gliders had been around for decades before the Wrights took to the air", a very questionable assertion. His knowledge of aeroplane structures and terminology also seems poor, as he states in the case of the B.E.2c that it had "a triangular insert in front of the tailfin to assist stability in yaw", when what he means is that a fin was added in front of the rudder. In an annotated diagram of the parts of a Camel on page 238, the cables linking the upper and lower ailerons are described as "incidence wires", and elsewhere interplane struts are described as "wing struts". He also fails to distinguish between gun interrupter gear and synchronisation, and military serial numbers are described as "airframe numbers".

In his early section on the predecessors, Sir George Cayley is deprived of his title, and the coverage of his work and that of Maxim ("little known"!), Lanchester, Cody and Dunne is superficial at best and omits many significant aspects. There is no mention at all of Horatio Phillips, who surely ought to have been included, but the "tower jumpers" Eilmer and Dante are included when they are really totally irrelevant. It is quite clear from his vague description that the author did not clearly comprehend the modifications made to the F.E.2b to equip it with cable fenders to deflect the cables of tethered balloons; a photograph of this installation would have been a great

help to the reader (and the author), but is not included. When referring to the spinning trials of the F.E.8, perhaps he should have consulted the reports from the period, rather than citing some 1960 memoirs from *New Scientist*. And when a photograph of the F.E.8 prototype appears on page 142, ten pages later, it is not identified.

Most of the illustrations are poor and grey, and quite a few could be regarded as superfluous, and ought to have been replaced by better ones more pertinent to the principal subject matter. The author displays a very poor standard of aircraft recognition. A Maurice Farman Shorthorn is described as a Longhorn, the B.E.2c on page 55 is an atypical version with an armoured forward fuselage (but we are not told this), and the aircraft incorrectly identified as "British Army Aircraft [sic: Aeroplane] Number One" on page 44 is the "Cody IIc" Michelin Cup biplane of 1910, a totally different machine. Worst of all, an F.E.2b on page 181 is identified as a D.H.4. I have yet to put a name to the man in the portrait on page 93, but it most certainly is not Geoffrey de Havilland.

While I am sure there is much useful material to be gleaned from this book, it is buried in a minefield of vagueness and errors.

PHILIP JARRETT

### *First Through The Clouds — The Autobiography of a Box-Kite Pioneer*

By Frederick Warren Merriam; Air World (an imprint of Pen & Sword), in association with The Aviation Historian; 6½in x 9½in (165mm x 241mm); hardback; 132 pages; illustrated; £19.99. ISBN 978-1-526726-16-2

"THE PAST IS a foreign country; they do things differently there". So wrote L.P. Hartley in *The Go-Between*. This is most certainly true of flying training in the years before the Great War. In this reissue of his 1954 classic, the author writes

# Flyleaves / Classic aviation books revisited

**Best Flying Stories.** Edited by John W. R. Taylor; Faber and Faber Ltd, 1956; 5½in x 8½in (140mm x 205mm); Hardback; 315 pages; typical price around £10

PUBLISHED ORIGINALLY AS part of Faber and Faber's *Omnibus Books* anthologies series, this volume aimed to deliver "among the best flying stories ever written anywhere in the world in the first exciting half-century of powered flight". From Guy Gilpatrick's recollections of American aviation's pioneering years to Jacqueline Cochran's early supersonic flights, this compilation of 19 extended extracts — from autobiographies (including Igor Sikorsky, Hanna Reitsch, Antoine de Saint-Exupéry); biographies (Manfred von Richthofen, Bernt Balchen, Jimmy Doolittle); fiction (including H.E. Bates and P.I.X.); 1919 imagining of a turbine-powered transatlantic flying-boat) and historical studies — is arranged chronologically by subject. Ten contributions describe events of the recent Second World War, including raids on Taranto in 1940 and Tokyo in 1942, ATA women, an Me 262 raid and Kamikaze pilots. One can relive the first flight over the South Pole ("a colossal, white-blanketed amphitheatre in which there were no actors") and of the V2 rocket among many key moments vividly described in one of the best aviation reads ever. **BRIAN RIDDLER** (former Chief Librarian, Royal Aeronautical Society)

lyrically, with a treasure trove of anecdotes, of this long-gone era, when learning to fly was more of an act of faith than a planned system, for both instructor and trainee. However, the author was a born teacher and developed his own very successful method of instruction, perched behind his pupil, on top of an exposed framework of wood, fabric and wire. His route to this career was singular, even for his time, having been an apprentice saddlemaker, antiquarian book dealer, chauffeur and mechanic, before learning to fly at Brooklands in 1911.

Merriam devised a system of non-verbal communication with the trainee, a vital requirement given that audible speech was all but impossible, demonstrating the more difficult manoeuvres first, in order to instil confidence. It was a perilous business, as shown by the number of accidents, injuries and fatalities he records. By July 1914 he had taught some 200 pupils at the Bristol School at Brooklands, including 29 of the first 90 RFC pilots to go to France.

During the war Merriam served as an instructor at Hendon and RNAS Chingford, also undertaking missions to intercept Zeppelins, making this comment: "To train a pupil to fly to be a war pilot on a very stable aeroplane would be like expecting a man to win the Grand National after only riding a carthorse".

In 1917 he flew anti-submarine patrols in seaplanes from Cattewater, dive-bombing a U-boat and, following engine failure, having to be rescued by a destroyer. By 1918 he was second-in-command at Padstow, flying Sopwiths on photo-mapping sorties. By the end of the war Merriam had flown 5,000 hours in 60 types and trained 1,000 pilots.

Post-war he tried his hand at joyriding, test flying, aeronautical consultancy, establishing gliding schools and farming. In the Second World War he served again, as a lieutenant-commander, mostly in aircrew and ground trade selection, before being medically retired in 1943.

This is a highly enjoyable and informative

book, with an excellent selection of photographs, which I thoroughly recommend. [We should point out that the author sent this review unsolicited and received no payment for it — Ed.]

## GUY WARNER

### **Jewish Flyers in the World War**

By Felix A. Theilhaber; Cross & Cockade International, Woodlea, Tattershall Road, Woodhall Spa, LN10 6TP; 6¾in x 9½in (171mm x 241mm); softback; 254 pages, illustrated; £25. ISBN 978-0-955573-49-1

This latest publication from Cross & Cockade is a greatly enhanced, revised and annotated English-language edition of a little-known book that first appeared in Germany in 1924, containing accounts of more than 120 German Jewish pilots, observers and air gunners who participated in the First World War, many of whom gave their lives. Dr Theilhaber, who was a military physician in the First World War, produced his book in response to a defamation campaign which portrayed German Jews as shirkers and saboteurs who had contributed to the nation's defeat in that conflict.

This well-illustrated new edition, edited by Elimor Makevet and Dr Dieter H.M. Gröschel and incorporating additional contributions by many researchers, uses an adapted translation of the first edition made by Adam M. Wait in 1988, and is the culmination of ten years' work. Of much greater scope than the 1924 volume, it includes an updated list of more than 200 German Jewish flyers, with details of their military service, lives and fates. It was especially enlightening to find that four German pilots often described as Jews or of Jewish extraction were not in fact Jewish, and were therefore omitted from the original book; they include Ltn d.R Werner Voss.

## PHILIP JARRETT



# BOOKS IN BRIEF

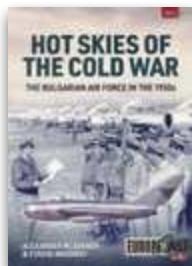
*A quick round-up of what else is currently available for the aviation history enthusiast*

## HOT SKIES OF THE COLD WAR: THE BULGARIAN AIR FORCE IN THE 1950s

*Alexander Mladenov & Evgeni Andonov*

*Helion & Co; ISBN 978-1-912866-91-5; £19.95*

HELION'S EXCELLENT @War series has branched out, and this second in the *Europe@War* series of 8½in x 11½in softbacks details the history of the Bulgarian Air Force during the 1950s, when the nation was at the sharp end of the Cold War, as the Soviet Union's southern bulwark against the West. With superb photographs throughout, the authors tell the story of this tense period from a little-covered perspective, and the chapter on the shooting down of an El Al Constellation that strayed off course in July 1955 is gripping. Includes rare colour photographs, a useful map and 18 colour profiles by Peter Penev. **NS**

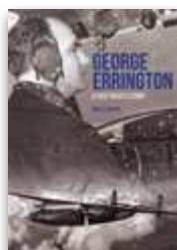


## GEORGE ERRINGTON — A TEST PILOT'S STORY

*Mike Phipp*

*Amberley Publishing; ISBN 978-1-445695-22-8; £16.99*

PROBABLY BEST KNOWN for his test-flying work on the Airspeed Ambassador, George Errington had a long and varied career in aviation before his death in a Trident crash, aged 64, in 1966. In this 6½in x 9½in illustrated softback, Mike Phipp uses Errington's own logbooks and various articles he wrote to trace his life in aviation, and the subject's own voice shines through. There are minor niggles, mainly relating to typos ("Popjoy" rather than Pobjoy and "Hiniadies" instead of Hinaidis) and misattributions (the name of the British weekly magazine was *The Aeroplane*, not *Aeroplane Magazine*), but the story, full of adventure and fascinating detail, is well told. The photographs from Errington's own albums are a treat, if rather flatly reproduced; one more run-through with a green pen might have made this good book an excellent one. **NS**

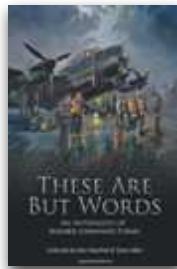


## THESE ARE BUT WORDS

*Compiled by Ken Marshall & Steve Allen*

*Mention the War; ISBN 978-1-911255-61-1; £15*

WE DON'T NORMALLY review books of poetry in *TAH*, but we are making an exception here because sales proceeds go towards the upkeep of the Bomber Command Memorial in London's Green Park. Subtitled *An Anthology of Bomber Command Poems*, it is a well-presented and often poignant collection of more than 70 poems, many of them written by members of the Air Gunners' Association. Available direct from [www.bombercommandbooks.com](http://www.bombercommandbooks.com). **MO**



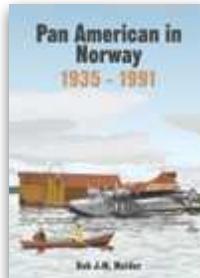
## PAN AMERICAN IN NORWAY 1935–1991

*Rob J.M. Mulder*

*European Airlines; ISBN 978-82-93450-10-8; NKR150*

TAH AUTHOR Rob Mulder self-publishes an extensive list of books, mostly on civil air transport with a Nordic flavour; this latest 76-page softback is well up to his usual high standard. Spanning seven

decades, from explorer Bernt Balchen's initial attempts to set up a New York–Norway service to the final Pan Am Airbus A310 departure from Oslo, the story also encompasses the post-war Norwegian operations of American Overseas Airlines in 1946–50, before Pan Am took the route over. Generously illustrated, the book offers previously-unpublished photographs, plus publicity shots, stylish airline posters and ephemera. Available direct from [www.europeanairlines.no](http://www.europeanairlines.no). **MO**

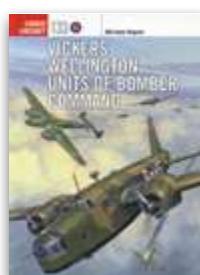


## VICKERS WELLINGTON UNITS OF BOMBER COMMAND

*Michael Napier*

*Osprey Publishing; ISBN 978-1-472840-75-2; £14.99*

IN THIS 133rd (!) volume of Osprey's tried-and-trusted *Combat Aircraft* series, TAH contributor Michael Napier profiles the career of the often somewhat overlooked Wimpy in RAF Bomber Command service, from its introduction in October 1938 to its retirement in the autumn of 1943 (it went on to serve with distinction with Coastal Command and in other theatres, of course). Comprising five chapters — *Origins and Early Days; Into Combat; On the Offensive, Peak Strength and Training* — this 96-page 7½in x 9¾in softback is well up to the popular series' impeccable standards and a steal at the price. **NS**



## VIGILANTE! A PILOT'S STORY

*Cdr Robert M. Powell*

*Specialty Press; ISBN 978-1-580072-61-8; £32*

FOR THE NORTH American A-5 Vigilante enthusiast, this 10in x 10in hardback book will be another welcome addition to the collection, focusing not on the nuts and bolts, but the arc of the type's service career, from creation to retirement. Engaging anecdotes, interspersed with boxes on design, operations and the politics, provide context for the reader. Also included are images this Vigilante fan has never seen before, credited to fellow air- and groundcrew. The paper quality is good, with clear and detailed illustrations. **J.D. BROSSART**



# Lost & Found

**PHILIP JARRETT** explores the lesser-known corners of aviation history, discovering little-known images and rediscovering long-lost details of aircraft, people and events. This time he revisits the Howard Wright Avis No 2 monoplane, more photos having come to light

**I**N THESE PAGES in *TAH16* I featured the previously overlooked Howard Wright Avis No 2 monoplane fitted with a four-cylinder Green engine. Now two further photographs have come into my possession. In these pictures the occupant is The Hon Alan Boyle, and salient features are the pair of very long tubular radiators beneath the wing roots, and the cabane carrying the upper bracing wires, comprising twin fore-and-aft inverted vees joined by a horizontal strut. The latter feature poses a problem, because the upper wing bracing wires of the machine depicted in *TAH16* were supported by a single inverted-vee strut arrangement. In addition, the pilot's basketwork seat appears to be positioned higher in the "new" pictures.

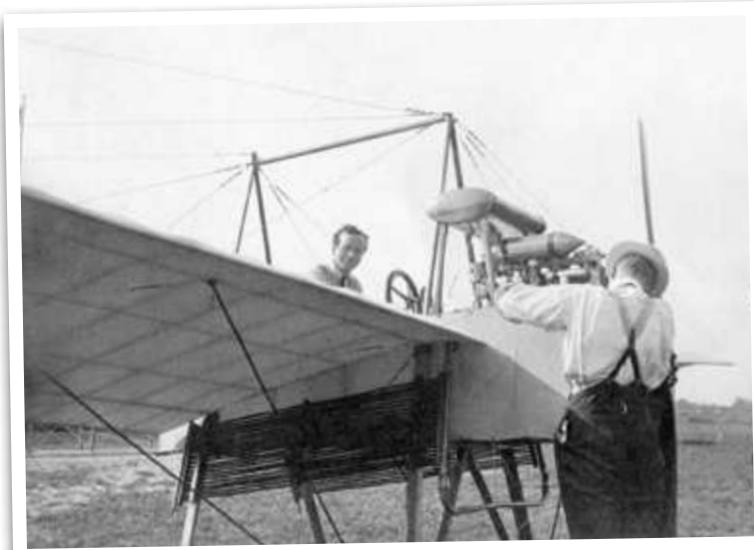
Things are not helped by the statement in Goodall and Tagg's book *British Aircraft Before the Great War* (Schiffer Publishing, 2012) that: "a report of a 35 h.p. Green being used in June 1910 may have been incorrect". This remark refers to a news item in the June 28, 1910, issue of *The Aero*, reporting that "Mr Boyle was experimenting [at Brooklands] with a new Avis machine fitted with a 35 h.p. Green engine. In this machine there remain certain adjustments



to be made, and consequently Mr Boyle did no actual flying with it, though it was off the ground on several occasions . . .". These photos of Boyle in a Green-powered Avis prove that *The Aero*'s report was definitely not "incorrect". Unfortunately it is uncertain whether they were taken at Brooklands or Lanark.

Although it was relatively easy to make quite major modifications at short notice in these early days, even engines being changed from one type to another overnight, one wonders whether we are looking at the same machine before and after modification, or two different aeroplanes that were both fitted with the Green engine and radiator installation at some point.

If any readers can throw light on this subject, please do feel free to contact the Editor!

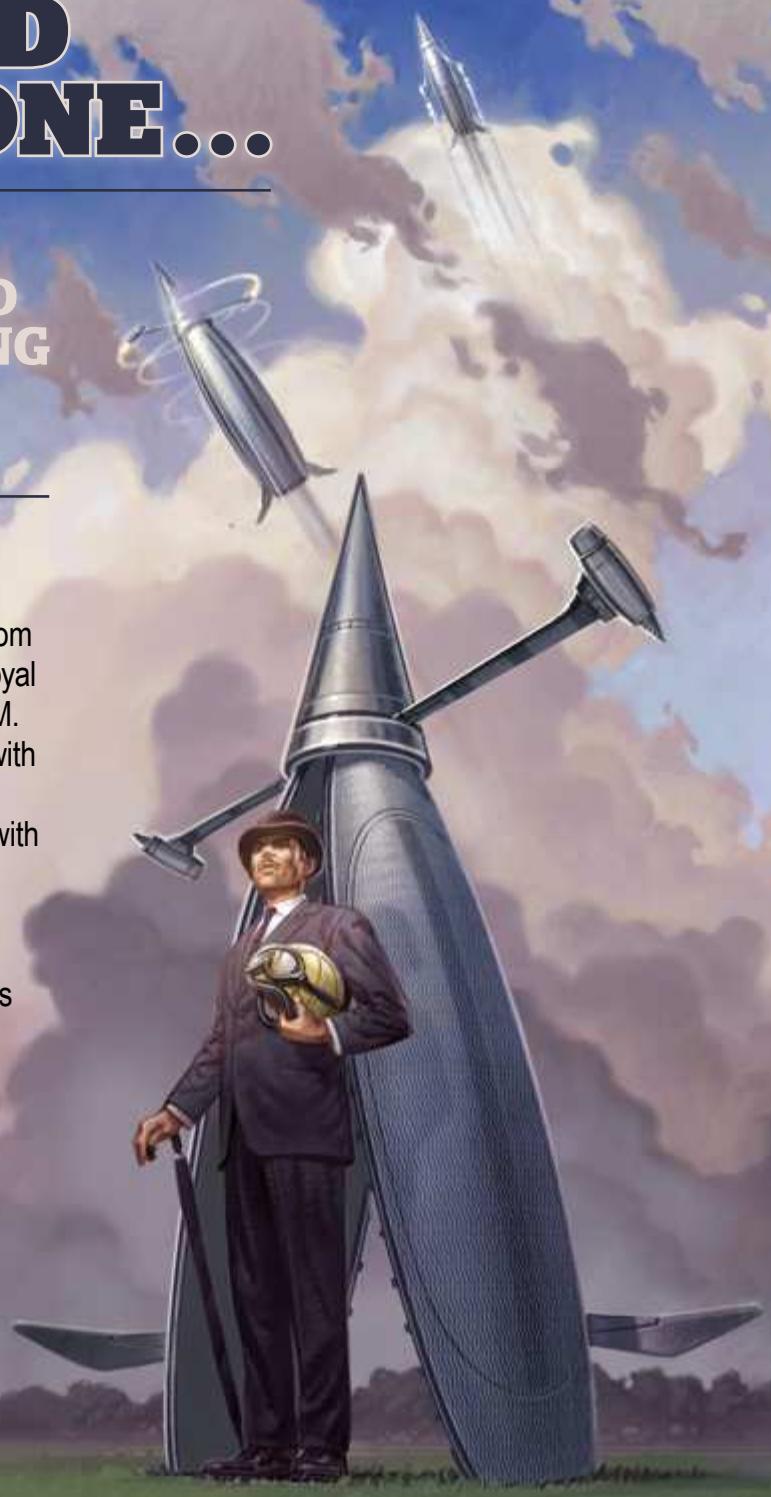


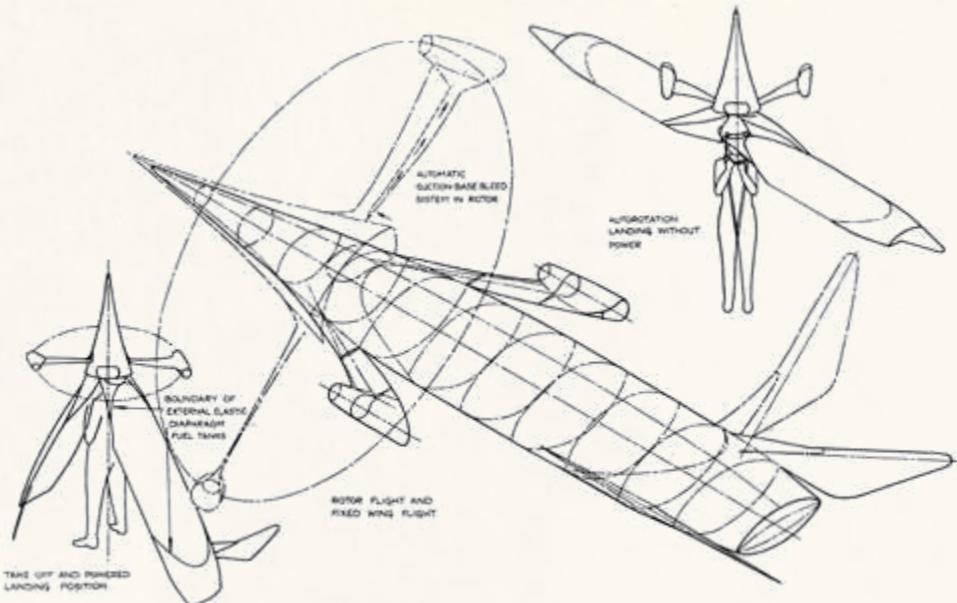
**LEFT & ABOVE** The two newly discovered photographs of The Hon Alan Boyle ensconced in a Green-engined Avis in August 1910. If you know more about these photographs, contact the Editor — see page 3.

# EVERY HOME SHOULD HAVE ONE...

## MR TUCKER'S FUR-COVERED MACH-5 FLYING SWISS-ARMY KNIFE

CHRIS GIBSON investigates another weird and wonderful British aeronautical concept from the late 1950s, in which the Royal Aircraft Establishment's Mr L.M. Tucker proposed doing away with long runways and crowded terminals and replacing them with hypersonic ramjet-powered VTOL-capable personal transports — it would certainly have sidestepped the problems of civil air transport during a global virus pandemic . . .





ISOMETRIC GENERAL ARRANGEMENT OF THE MINIMAL AIRCRAFT IN ITS VARIOUS FLIGHT STATES.

**I**N MY ARTICLE *Hawker's Star Destroyer* in TAH32, that company's design study for a nuclear fusion-powered 120-ton flying-boat was described. Here, continuing the exotic theme, the opposite end of the aircraft spectrum is examined — the "Minimal Aircraft".

In November 1957 the Royal Aircraft Establishment (RAE) produced Technical Memorandum No 245, the snappily titled *An Analysis of a Ramjet Convertible Wing Rotor, and Allied Multifunctional Devices and Comparison with Other Forms of Propulsion for VTO Aircraft of Mach 4-0-5-0 Cruising Speed*. Written by Mr L.M. Tucker, this was just the kind of work expected of the RAE in the late 1950s when ramjets, rotary wings and hypersonics were the next-big-things; but combining these in one airframe was, shall we say, novel.

### THE VIEW FROM 1957

The abstract outlines an aircraft with a "ramjet tip-driven rotor which is convertible to a fixed swept wing capable of Mach 4-5 cruising speed" and which has "multifunctional properties". The paper begins by describing how, owing to ever-increasing population density, ground-based transport systems would become increasingly

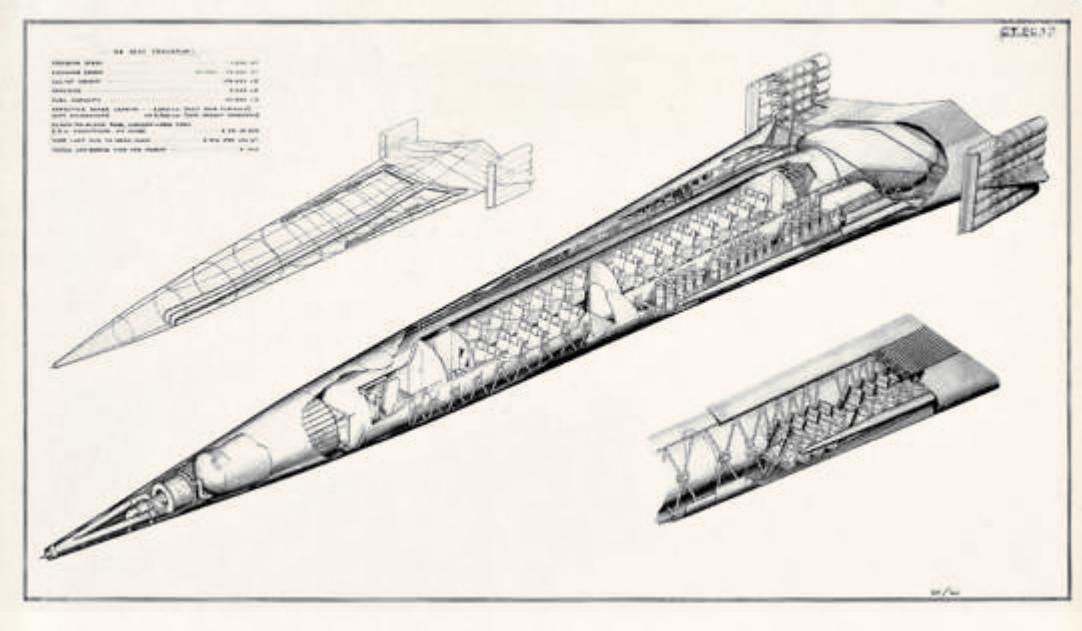
**ABOVE** *Is he wearing that aircraft?* This illustration from Tucker's RAE paper shows his concept for a single-place ramjet-powered VTOL aircraft that could address the problem of transport congestion and larger, ever-expanding airports. Essentially a Mach 5 motorcycle, it looks like an excellent way to break a leg — or worse. THE NATIONAL ARCHIVES

fraught with accidents and congestion, making air travel the most practical means of transport. In 1957 large jet aircraft required runways nearly two miles long, and terminal crowding, coupled with the need for ground transport to the final destination, made vertical take-off and landing (VTOL) aircraft the only viable type for the future.

Tucker was of the opinion that "to be far sighted . . . all forms of runway-operated aircraft will sooner or later become an acute embarrassment" and that all future passenger aircraft should be "non-scheduled and possess VTOL performance". In Tucker's view, smaller high-performance VTOL aircraft, operating on an *ad hoc* basis, were the "only type worth further study".

Listing the advantages of such types, Tucker describes how a small hypersonic VTOL aircraft could eliminate stage length and termini limitations, while the machine's high speed could simplify navigation, as it could dispense

**OPPOSITE PAGE** Smithers-Jones prepares to don his helmet for his commute from the suburbs to his job in the city in his single-place VTOL "Minimal Aircraft", fitted with a ramjet tip-driven rotor which converted to a swept fixed wing for horizontal flight. Of course. Commissioned artwork by MARK HARRIS ([www.markharris.ca](http://www.markharris.ca)) © 2021



ABOVE An example of the type of VTOL aircraft that Tucker viewed as unsustainable as a civil transport, this design by A.A. Griffiths for Rolls-Royce required 56 engines to lift its 100,000lb (45,000kg) all-up weight and another 12 for propulsion at 1,000kt. It carried 44 passengers — only twice that of Tucker's design, for five times the mass.

with radio navigation aids and use inertial navigators, which at that time were accurate for only up to an hour. Further advantages of short flight times included alleviation of the effects of kinetic heating and more basic accommodation, since the comfort requirement for passengers varied "inversely with flight time, making a lighter, simpler fuselage and passenger equipment possible". Tucker also makes an economic case for the type, with its ability to be refuelled anywhere, allowing it to operate point-to-point at "its optimum fuel/payload ratio irrespective of total journey length", thus reducing costs.

Tucker states that large VTOL aircraft with greater payload/more passengers, such as A.A. Griffith's designs for Rolls-Royce, "defeat their own primary objective of literal door-to-door transit" as these needed surface transport systems to and from an airfield suitable for handling large aircraft. This factor alone "favours small, if not individual, aircraft". Small aircraft could be produced in large numbers, with rapid development and, if small enough, dispense with complicated powered controls. Economies of scale would provide a cheap accessible aircraft, with individuals being able to afford their own aircraft that they could operate from their back yards, much as the private automobile has been since 1945.

One of the drivers of aircraft size was the need for a payload, such as passengers, who on a long flight required "breathing space" in the cabin, Tucker describing the latter as having a

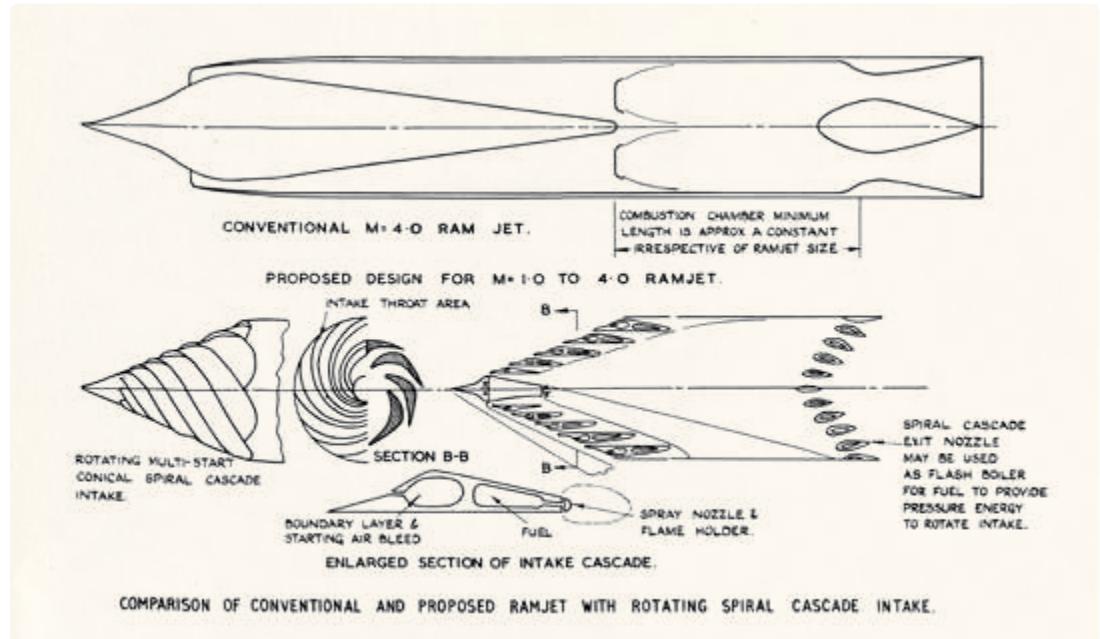
"low effective density" necessary for passenger comfort. Tucker explains that "passenger cabin density could be greatly increased for short durations without going beyond the minimum comfort requirement if unconventional accommodation such as supine or prone were considered". Cram them in like sardines in a can, they'll be fine for a short time! Sounds like flying in an offshore-support helicopter — horrid.

The brevity of this period of discomfort was to be achieved by flying at Mach 5, and Tucker's vision was for not only a VTOL Mach 5 aircraft for an individual — a hypersonic motorcycle or sports car if you will — but also a hypersonic 20-seater aircraft (20 passengers plus pilot — no drinks trolley, obviously) to move passengers between city centres.

The intensity of sonic booms had been shown to "reduce as the square root of aircraft linear dimensions", so size also impacted noise signature, with a smaller aircraft producing a less energetic sonic boom. Since most jet noise is generated on take-off with the engines working at their least efficiency, an alternative means of leaving the ground was desirable. For a small aircraft, a tip-driven rotor seemed the ideal solution; and for minimum weight and maximum simplicity, a ramjet-driven rotor was ideal.

## A FLYING SWISS ARMY KNIFE

In a Mach 3+ aircraft such as Lockheed's SR-71, the engines' turbomachinery operates only in the low-speed portions of a flight. A great deal of weight can be saved by dispensing with



ABOVE A standard ramjet such as the Bristol Siddeley R.2/BS.1006 Mach 4 research engine was unsuitable for tip mounting, so Tucker suggested the "multi-start conical spiral cascade intake" to reduce the length of the ramjet, which rotated to form a dynamic diffuser to reduce the air velocity before it entered the combustion chamber.

the compressors and turbine sections of the engines to produce a ramjet. Unfortunately, ramjets cannot produce static thrust and work best at speeds approaching Mach 1. In a conventional VTOL aircraft, a ramjet is useless and requires some other means to take off and land, particularly to provide directional control at low speed. Tucker's solution was the Ramjet Convertible Rotor (RCR), which addressed all the concerns about weight, efficiency and control throughout the flight envelope. Plus it had the added bonus of addressing the spectre that haunts every aircraft designer — weight.

Minimising weight is one of the most important aspects of aircraft design and especially so in a VTOL aircraft, as the propulsion system must support the total weight of the aircraft at take-off and landing. While materials and structural design can contribute greatly to weight reduction, a more innovative approach is to make the components of the aircraft perform a variety of functions. This was the aim of Tucker's RCR, which comprised a two-bladed rotor with inverse-tapered blades, fully variable in pitch, carrying a swivelling ramjet at each tip. The blades could also be feathered to become a swept wing for high-speed flight, with all phases from take-off to landing powered by the ramjets. The objective was to maintain a "constant helical tip speed" to ensure the ramjet operated at its optimum efficiency by either varying the rotor blades' pitch and rotation speed, with maximum rotor r.p.m. at take-off, or at optimum speed with the

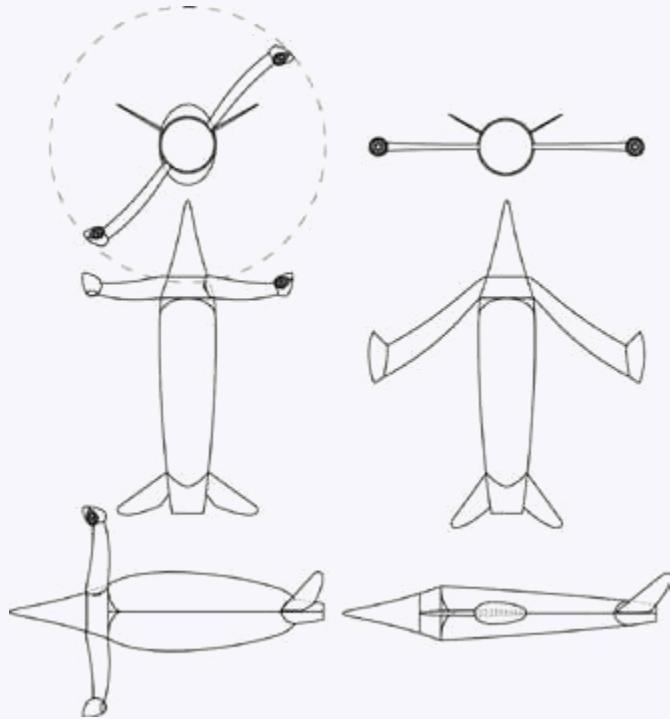
blades fixed as wings in the cruise.

The inverse taper of the blades was driven by two factors; the need to balance lift across the span of the blade and to facilitate the conversion to fixed-wing flight. Another method for improving the efficiency of the blades/wings was to reduce the sweep outboard to produce a crescent shape. Tucker was also concerned about roll control at high speed, his solution being to use the tip-mounted ramjets as controls and use the rotor hub to make the rotor/wing assembly independent of the fuselage, thus smoothing out the manoeuvres and reducing their impact on the passenger or passengers.

## THE POWER

Conventional supersonic ramjets, such as Bristol Siddeley's Thor on the Bloodhound II surface-to-air missile, are long devices owing to the need to reduce the supersonic airflow at the inlet to subsonic flow at the combustion chambers. The various ramps and diffusers are formed by low angles of slope to smooth the process. Such ramjets are not practical when tip-mounted, so a more compact system was required. This could be achieved by "cascading" the intakes and nozzles. The intakes comprised a small centre-body from which emerged single or multiple "start" spirals to ensure smooth airflow, which, if rotated, became a supersonic diffuser.

Fuel would be fed to the ramjets from two flexible rubber fuel bags, protected by expanding shells that formed the outer skin of the aircraft. The fuel bags were to be joined to the fuselage



**LEFT** This general arrangement illustration shows Tucker's "Minimal Aircraft" as a VTOL aircraft with ramjet-driven rotor on the left and as a Mach 5 aircraft on the right. Of note in the left-hand illustration are the fuel tanks forming the fuselage outer surface, seen in their fully fuelled expanded state. The right-hand illustration shows the aircraft in its configuration with inverse-tapered crescent fixed wings.

ARTWORK CHRIS GIBSON © 2021

**BELOW** The idea of a VTOL aircraft for point-to-point travel — in which passengers could be transported directly into the urban fabric of a town or city, rather than having to land at an airport miles from the city centre and travel into the latter on a ground transport network — was explored by Fairey and its Rotodyne compound helicopter. It ultimately proved uneconomical and prohibitively noisy.

at the sides and, when pumped full, expanded to impart pressure on the fuel from the stretched rubber. The expanding shell would comprise a series of overlapping scales that would need to withstand kinetic heating at high speed. To protect these, and the nosecone, Tucker suggests covering them with "fur". These short-pile glass fibres would trap an insulating layer of static air underneath the flattened fur, protecting the airframe. A further benefit of the fur was the effect seen in aquatic animals such as fur seals, with the tip of each hair acting as a vortex generator to control the boundary layer.

The aim of the flexible external fuel tanks was drag reduction, with the aircraft cross-section reducing as fuel was consumed, thus achieving the optimum shape for high-speed flight once most of the fuel was used for take-off. The fuel

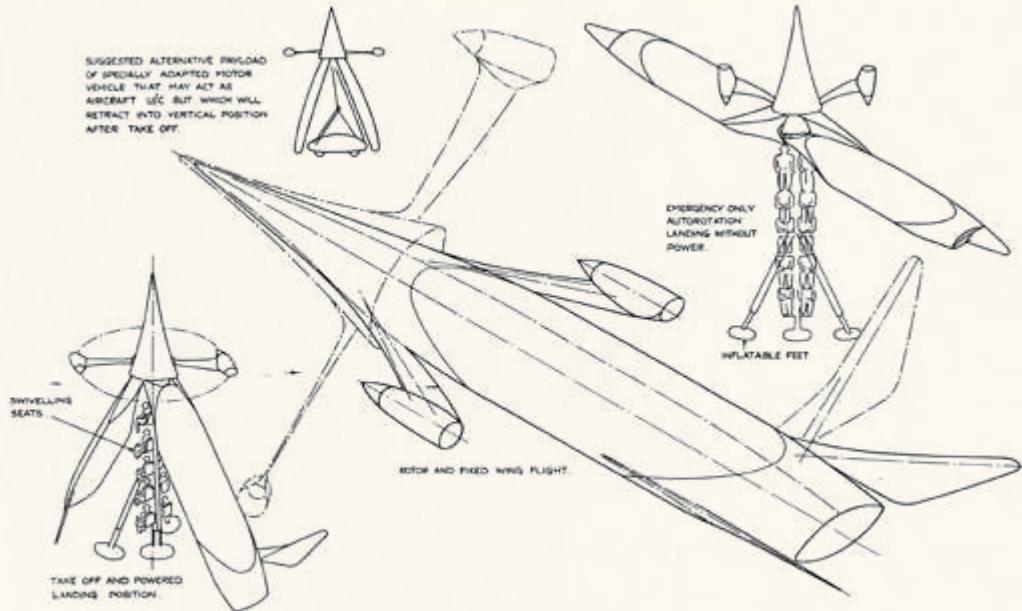
tank could also be modified to absorb radar waves, producing an aircraft that would "for all intents and purposes be invisible" — a rather odd characteristic for a passenger aircraft.

The rotor would turn on a large roller bearing that could be converted into an electrical generator by adding electrical windings. This generator could also be used as an electric motor to spin-up the rotor on the ground, taking its power from a ground starter or the national grid. Ground-based spin-up could bring tip velocity to a speed at which the ramjets could be lit and allow the aircraft to take off.

Tucker also examines flight profiles and their effect on the economics of the vehicle's operation and ways that it could be simplified. The first of these was to convert from rotary-winged to fixed-wing flight as soon as possible. The second

TAH ARCHIVE





ISOMETRIC GENERAL ARRANGEMENT OF A RAMJET CONVERTIBLE ROTOR-WING AIRCRAFT OF ABOUT 21000 LB. TAKE OFF THRUST.

was to climb to 30,000ft (9,000m) before reaching supersonic speed to reduce the sonic boom. Thirdly, the flight profile should allow the cabin to be pressurised by ram air (there being no engine compressors to tap) and finally produce a minimum-fuel climb.

### AND IF IT ALL GOES WRONG...?

Tucker's view was that the most economical size for the "Ramjet Rotor Aircraft" was the single-seater, as it only required a harness for the pilot, who effectively donned the aircraft and became the undercarriage; shades of pilots "strapping on" a Folland Gnat. A larger passenger-carrying aircraft would need some form of undercarriage, which would add weight. A central spine, incorporated into the structure, could form the main support for an undercarriage, with small outriggers to keep the vehicle stable.

This central spine could not only function as an undercarriage, but the passenger seats could be attached to it, with the seats swivelling as the aircraft changed attitude from vertical at take-off and landing to horizontal in the cruise. Access to the seating would be eased by the two halves of the fuselage opening like clamshells, with hinges just aft of the rotor. How the passengers would feel about being the meat in a fuel sandwich would make for an interesting discussion.

Tucker also explains that the two outer shells would have two further functions. In the event of engine failure in the VTOL phases, the panels could swing out and become "an emergency

**ABOVE** A larger version of Tucker's aircraft was to carry 20 passengers in somewhat austere conditions. The drawing at top right shows the aircraft in emergency autorotation mode, with the clamshells acting as rotors; the wings have been rotated forward to clear the "rotor" disc. At bottom left the aircraft is shown on the ground with passengers embarked.

autorotation rotor", and if the engines failed over the sea in the cruise phase, the vehicle could glide to a water landing. Once alighted on water, the fuel tanks would be inflated with CO<sub>2</sub>, one half-shell would form the hull of a lifeboat while the other half could be raised as a sail.

In summary, Tucker notes that the advantages of the vehicle lies in its multifunction design, low-weight propulsion system, single-engine safety on take-off and landing (plus the emergency autorotation) and the lightest and simplest fuel system possible. With the all-moving ramjets offering the best control at high speed and the elastic fuel tank reducing airframe size as the flight progressed, Tucker states that the "Ramjet Convertible Rotor Minimal Aircraft" provides the answer to all future needs in the field of air transport.

Tucker, writing in 1957, may have been more prescient than we think. Even a year ago, his concept would have been a mere curiosity to be scoffed at, a mad idea even. In late 2020, with bizjet charters booming and mass air travel in crisis owing to a global pandemic, perhaps Tucker's fury Mach 5 motorcycle is the key to post-Covid air transport . . .



Piasecki HUP-2 Retriever c/n 253, formerly 130076 with the French Navy, is painted in an attractive, if somewhat vivid, orange-and-cream colour scheme. It is on display at a roundabout at the Baris Business Park in Rotterdam.



PHOTOGRAPHS BY THE AUTHOR

# OFF THE BEATEN TRACK

*Ever turned a corner to find something unexpected? The Aviation Historian's intrepid aeronautical explorer PETER DAVISON investigates the stories behind the oddities that turn up in the most unusual places . . .*

IT'S ORANGE, it must be Holland. Sure enough, although the type was never operated by the *Koninklijke Marine* (Royal Netherlands Navy), this Piasecki HUP-2 Retriever twin-rotor helicopter is displayed on a roundabout in the industrial suburbs of Rotterdam, and serves as an eye-catcher for a local industrial estate.

The single-piston-engined HUP-2 originated from a 1945 US Navy requirement for a shipborne helicopter, with initial deliveries beginning in 1953. One benefit of the type's 35ft (11m)-diameter overlapping dual rotors was its ability to use carrier lifts with rotors deployed. The HUP-2 saw service in the Korean conflict, an underside hatch, revealed beneath a folding cockpit seat, incorporating a hoist for underslung loads and personnel recovery. Those that served with the US Army were designated H-25A Army Mules.

France and Canada were the only foreign operators of the type, with 15 and 3 respectively. This example, formerly *Aéronavale* serial 130076 (c/n 253) is one of only two survivors in Europe. The first report of this machine in Rotterdam was in 1973; the French Navy retired its examples in 1964, so where this one was stored for the intervening years is not clear — possibly Lanveoc in Brittany, but there is no official confirmation.



ABOVE The Retriever is in remarkably good condition and serves as an excellent landmark and talking point for visitors to the business park. To find it on Google Earth enter the co-ordinates 51°51'49.6"N, 4°28'29.5"E.



Find us on Facebook at [www.facebook.com/TheAviationHistorian](http://www.facebook.com/TheAviationHistorian)  
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## Coming up in future issues:

**The Patagonian Eagle** After a decade of research, Ricardo M. Lezon provides the most in-depth history ever published of Argentina's "homegrown Hornet" — the IAe 30 Ñancú

**The Other Sound Barrier** Aerodynamics specialist Matt Bearman explores the effects of supersonic shockwaves on propellers; are these the true limiting factor for props?

**Bringing Africa Together** Maurice Wickstead opens a new two-part series on the evolution of Ethiopian Air Lines, one of Africa's most successful flag-carriers



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